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CHARLES W. PRICE . . . . . PRESIDENT AND EDITOR
STEPHEN H. GODDARD . . . . . SECRETARY AND MANAGER
WM. HAND BROWNE, JR. . . . . TECHNICAL EDITOR
AINSLIE A. GRAY . . . . . MANAGING EDITOR

PUBLISHING OFFICE . . . . . 13-21 Park Row, New York
WESTERN OFFICE: Fisher Building, Chicago, Ill. L. W. MARSHALL, Manager
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PROPER RECOGNITION OF SCIENTIFIC WORK.

Time and again attention has been called to the fact that at the present time workers in purely scientific fields do not receive that financial return which would correspond to the value of their labors. Such men are usually connected with some institution of learning and divide their time between instruction to students and investigation on their own behalf. The scientific work is done purely for the sake of science and it seldom brings any reward other than honor and the satisfaction which goes with well-spent efforts. If such workers could live in a world differing as much from that of the ordinary mortal as the former's work does from that of the latter their worldly needs might be less; but, unfortunately, this can not be. They must provide bread and butter and shoes and other necessary articles, purchased in the same market where their more liberally recompensed neighbors buy. Their expenses are not decreased in any way because of the character of work which they are doing; in fact their expenses are frequently increased by outlays not for personal needs. Yet, because of the character of their work their salaries are low, when compared with that of the commercial man whose work is certainly of no greater value to the world at large. This is a most unfortunate condition, for not only is the man of science hampered in his true work but the greater returns which he can frequently secure by applying his knowledge in useful ways not infrequently turns him aside from his true work. There is, of course, no disgrace in applying scientific knowledge—indeed, so far as the world is concerned this is the true end of all scientific work. But science itself suffers when its best workers are drawn away from their true work.

This subject was discussed at some length by the retiring president of the American Society for the Advancement of Science, Dr. W. G. Farlow, during the recent meeting at New Orleans. He spoke of the various conditions under which such men work and seemed to think that the conditions at a university or college are the most suitable for advancing science. It has been suggested that it might be of aid to establish prizes, to be awarded to those most deserving; in fact, this has already been done to a slight extent. But a small, or even a large number of prizes will not benefit science as a whole. What is needed is not a few large sums of money, which a few fortunates may secure, but a suitable return for all who give the best years of their lives to advancing human knowledge. Science to-day is so large that an enormous army of investigators is constantly at work day and night in pushing researches in all directions, and a prize awarded to some one distinguished man, however well deserved, does not assist the rest. The only way of meeting the conditions is to award to each person a return to some extent equivalent to the value of the work which he is doing.

But this is not all. Scientific investigations are frequently expensive. Often a man who has carried his work to a certain stage is halted because he can not secure the means of going further. Very frequently money which is paid to such men to meet their personal needs goes toward meeting the expenses of an investigation which will not bring any return in money. Therefore not only should decent salaries be paid but scientific institutions should receive such financial support as will enable them to carry out their work. During the last few years conditions have improved somewhat. The salaries of university instructors have been raised, but they are still far below what the same men can secure in commercial work. To the state institutions also the governments are being more liberal than they were five years ago, but there is still much to be done. In fact, only a start has been made in this direction. In our political systems things move slowly. Legislatures do not

appropriate money for purposes which are not supported by public opinion, and time is required to bring the public to seeing such matters in the proper light. But a start has been made which, to say the least, is encouraging, and progress is likely to be made, for we seldom go backward in such matters. Whether men of science will ever receive salaries equivalent to those paid in industrial work is immaterial, so long as the difference is not too great. When one with the true spirit can feel assured that he will be able to live as becomes his position in society, and that he will be assisted in carrying out purely scientific work, the increased pay of industrial positions will not have much attraction.

CHICAGO, THE ELECTRICAL CITY.

The electrical show, held at Chicago, Ill., from January 15 to January 27, has been a source of much satisfaction to its sponsors and productive of direct results to those who were fortunate enough to have exhibits on view. Not only was there present a host of representative electrical manufacturers from every quarter of the Union, but it is estimated that from seven to eight thousand visitors were present each day manifesting a keen and intelligent interest in everything electrical. There is no longer surprise at electrical accomplishments; the public is taking it for granted that but little is impracticable or impossible—what everyone is interested in knowing is "how far may I go, and what will it cost?" These questions kept a large staff of representatives busy with, as may be judged from the general enthusiasm, satisfactory material results. On other pages we present a comprehensive review of the exhibits and general features.

The convention of the Northwestern Electrical Association was well attended; the papers were on timely subjects, and the interest was of a high order. At the convention of the American Electrical Salesmen's Association several good papers were read and some valuable discussion indulged in.

FORCED DRAUGHT FOR MOTORS.

Not many years ago the application of forced draughts to steamships—particularly men-of-war—in order that the capacity of the boilers might be increased, and thus a higher speed attained, was a matter which received a great deal of attention. Under the normal conditions of steaming, a certain boiler equipment is ample, and space limitations prevent the addition of a reserve; therefore the expedient of increasing the rate of combustion in the furnaces, so as to enable an increased amount of steam to be generated to provide for bursts of speed when necessary, was almost forced upon naval architects.

Later, when other advantages of forced draught had been appreciated, such, for example, as the control which it gives over the rate of combustion and the saving which in some cases may be made by doing away with an expensive chimney, it was used in boiler houses on land. This application has not been general, since the great advantage of forced draught—that of enabling the output of the boilers to be increased—is not so necessary.

Still later, when the electric transmission of energy began to take an important place in the world another useful application of forced draught was made. The rating of certain electrical apparatus, such as transformers, generators and motors, depends, to a large extent, upon the rise in temperature due to internal losses. In transformers in particular, where other factors such as commutation do not come in, the rating of each piece of apparatus is practically determined by the rise in temperature which it can stand without being injured. Any method, then, for enabling a given piece of apparatus to do more work without having its temperature rise above the safe point increases the load which that device can carry safely. In other words, any method of carrying away the heat developed in a transformer in effect increases its size to a corresponding extent. One of the principal methods of accomplishing this end is the application of forced ventilation—forced draught, as the steam engineers call it. Here its principal advantage is in the decreased cost thereby secured. Transformers are essentially compact devices, offering small radiating surfaces. As the size of the apparatus is increased the radiating surface does not increase in the same proportion; hence the great advantage of artificial cooling.

Forced draught having thus been so beneficial in transformer development, is now entering into a new field. In the design of electric locomotives the electrical engineer finds himself considerably hampered by the small space available for his motors. Years ago, railway engineers fixed upon a track gauge which then suited their requirements. Unfortunately, this happens to be rather narrow for the large locomotives which to-day are becoming common. The steam locomotive builders, while feeling the restrictions thus enforced, can overcome them, partially, by building upward, if they can not build out. The electrical engineer can not do this so well, as he must place his motor between the wheels, and he must make it as compact as possible. This problem of constructing a high-power electric locomotive is being met in various ways. Locomotives are made in units and equipped so that two or more units may be coupled together and operated as a single machine, an arrangement which allows a greater number of smaller motors to be used. But when it is desirable to increase the size of the individual motor, and thus reduce the number necessary, the problem of ventilation becomes troublesome. Although, due to their motion when at work, the ventilation of traction motors may be better than that of stationary motors, recent developments in heavy railroading have shown that it may be desirable to adopt forced ventilation in order to increase the safe-working load of the motor; therefore we find, in a number of recent electric locomotives, apparatus which, by forcing air through the motors, makes it possible to dissipate more heat than could be carried off by the ventilation produced under normal conditions. A locomotive thus equipped and supplied with a certain size of motor will be able to do more work than a similar locomotive without the forced draught.

Although, by means of forced draught, the outputs of a boiler and an electric motor are each increased, the means by which this is attained are different in the two cases. In the

boiler, forced draught increases the rate of combustion, raises the temperature of the furnace and, unfortunately, the temperature of the escaping gases. It therefore tends to increase the losses as well as the ability to do work. In the motor the value of forced draught is in keeping down the temperature by carrying off the heat developed by the losses taking place in the motor. At the same time, on account of this cooling action, the losses which take place are less than what they would be if the temperature was allowed to rise.

THE ELECTRIC AUTOMOBILE.

The two automobile shows, held last week in New York city, demonstrated that the electric automobile is beginning to find that favor with the public which it deserves. While, compared with the total number of cars shown, the electrics were in a small minority, compared with the previous exhibitions the showing was admirably satisfactory. For trucking purposes and other heavy city work the electrically driven automobile some time ago proved its superiority. In ease of control it is unequaled, and its ability to stand overloads is greater even than that of the steam machine. The simplicity of the entire equipment is greater than that of any other type of car. For this reason the liability to derangement is less. The fact that one charge of the batteries gives a normal range of only about forty miles has no disadvantage for city service.

On the other hand, for pleasure purposes and for transporting persons, rather than things, the electric automobile has not made as much progress as its friends looked for. One cause has been the unfavorable comparison made between its limited range of action and the much greater range of the gasoline machine. The latter machine can go on indefinitely, provided, of course, it can obtain fuel when necessary, and provided it does not break down. The electric makes, say, forty miles, and then must stand by for recharging, and this the advocates of the gasoline machine have put down as a great disadvantage. It has, undoubtedly, prevented the public from taking up the electric type as readily as it might have.

Now, no one disputes the fact that the electric machine has a limited range on one charge, but this is only a drawback when one wishes to make a trip of over forty miles without a stop. Whenever the distance to be covered is not greater than this the electric can not be considered inferior to the gasoline or steam machines in this regard; and in all other respects it offers its peculiar advantages. For getting about the city or for a little jaunt into the country, a range of forty miles is more than sufficient. Indeed, it is very probable that the greater part of the work done by most automobiles is just of this character, and that it is comparatively seldom that they are called upon to make long trips, yet the majority of automobile owners sacrifice the advantages of the electric car in order to get a machine capable of doing something which it is seldom called upon to do. No one to-day goes shopping with a coach-and-four; a quiet and easily handled steed is far more desirable, and for this class of work the electric automobile is unexcelled. It is noiseless, inoffensive and easily controlled, even by a woman. During the night it receives a charge sufficient for the next day's work, and with ordinary care and inspection it can be relied upon to do this work without balking. In fact, its qualities are just those which make the family horse so valuable, and it is eminently gratifying to all who have watched its development during the last few years, sometimes in the face of much discouragement, to find that at last the public is beginning to appreciate it and that it is becoming more and more popular. That an appreciable start has already been made was clearly shown by the interest taken in the electric machines at the two shows, as well as by the fact that more builders are taking up this class of automobiles.

COOPERATION.

The annual convention of the National Electric Light Association will be held at Atlantic City, N. J., June 5, 6, 7 and 8, 1906. It is expected that this will be one of the most important meetings this association has ever held. It is unnecessary to predict that a fine literary and entertainment programme will be prepared; and assurance is given that provisions will be made for the exhibit of apparatus by manufacturers who are members of the association.

During the last few years a gradual change has been noted in the tone of the discussion before this body, the element of commercial interest taking bit by bit a more prominent place in the proceedings. The central station managers are fast waking up to the possibilities of making the endeavors of the engineer more worth while by creating a greater demand for the product of his skill and perseverance.

At the last convention of the National Electric Light Association a plan was launched looking to the cooperation of everyone interested in the production of electricity in fostering a greater demand for current-consuming devices, necessarily increasing the load at central stations.

An analysis of the present-day central-station situation sums up more or less in this wise: "We are comfortably loaded, but we are going to put in more apparatus." In other words, by divers ways more people are becoming interested in the uses of electricity, and the use of more current means the inevitable buying of more apparatus from the lamp or curling-iron heater back to the generating unit and boiler equipment.

On another page of this issue we publish an announcement of the plans which have matured since the last convention, when a large organization of lamp manufacturers put forward the suggestion above referred to. We can not be other than in favor of any plan properly conducted that has for its purpose the use of more current. This means more apparatus and a wider range of usefulness for electricity. It means that electricity shall stand first and foremost as the agent of mankind in every department of industry and domesticity. In this we are vitally interested.

THE ELECTRICAL NATURE OF MATTER AND RADIOACTIVITY.

BY HARRY C. JONES.

CHAPTER XVII.—(*Concluded.*)

THE MORE IMPORTANT FACTS IN CONNECTION WITH THORIUM.

The facts in connection with thorium are more numerous than with uranium. Thorium, like uranium, gives off α, β and γ rays. It undergoes a continuous transformation, yielding a new form of radioactive matter known as thorium X, at the same time setting free α particles.

Thorium X gives off α and probably β particles, and yields an emanation—the thorium emanation—which is an inert gas. This emanation gives off α particles and forms emanation X or thorium A, a radioactive solid which undergoes still further decomposition in at least two stages. In the first stage no rays are sent out, while in the second stage α, β and γ rays are emitted.

Since thorium gives rise to an emanation which decomposes into a solid form of matter—emanation X—that is radioactive and deposits upon other objects, thorium is capable of inducing or exciting radioactivity in bodies placed in its neighborhood. Thorium thus differs strikingly from uranium, which forms no emanation, and which, therefore, can not induce radioactivity in neutral objects even when in close proximity to them.

THE MORE IMPORTANT FACTS IN CONNECTION WITH RADIUM.

The best studied of all the strongly radioactive substances, by far, is radium. Its radioactivity is at least a million and a half times that of metallic uranium, which is taken as the standard unit.

Radium does not yield any radioactive substance analogous to uranium X or thorium X. It appears to produce the emanation at once from itself, giving off α particles. The emanation gives off α particles, and emanation X or radium A results. This undergoes a number of transformations, no less than five having already been recognized. During the first transformation α rays are sent off; during the second no rays are emitted, while during the third stage of the transformation α, β and γ rays are all given out. During the fourth stage of the transformation no particles are set free, and so on. Radium possesses a number of unique properties, all of which are very remarkable. Radium is the only known chemical element that produces of itself another chemical element, or can be made to produce such by any known means. Radium, or, more exactly, the radium emanation, in undergoing decomposition spontaneously yields the element helium. This discovery was so surprising and so directly at variance with all of our previous conceptions of a chemical element, that it was subjected to the severest experimental tests. It has withstood all criticism, and is beyond doubt a fact.

A number of the other properties of radium are scarcely second in importance to the production of helium by it. Radium has the power of charging itself electrically, and it is the only substance known that has this power.

Radium also has the power of producing light or becoming self-luminous.

Most remarkable, however, is the amount of heat energy that is being continuously set free from radium. It will be remembered that radium produces enough heat to melt its own weight of ice every hour. Since the heat of fusion of ice is eighty calories, this is the same as to say that radium liberates enough heat to boil its own weight of water every hour.

When we consider the very long time over which radium can thus continue to give out heat energy, we see how enormous is the amount of energy that this substance can liberate. It is of a magnitude entirely incomparable with the amount of heat set free in the most strongly exothermic chemical reactions. The enormous magnitude of the energy that can be liberated by radium must be classed as one of the most important discoveries in modern science.

With the facts enumerated above at our command, we can now proceed to discuss intelligently the generalizations and conclusions that have been reached as the result of the study of radioactivity.

THEORY OF RUTHERFORD TO ACCOUNT FOR RADIOACTIVE PHENOMENA.

The only theory thus far proposed, which accounts at all satisfactorily for the phenomena discovered in connection with the radioactive elements, is that advanced by Rutherford. The key to this theory is *that the radioactive elements are unstable.* The atoms of these substances represent *unstable systems,* which are continually undergoing rearrangement and decomposition. A definite number of the atoms of any radioactive element become unstable in any given time. They throw off an α particle, and the next stage results. In the case of uranium and thorium, we have formed uranium X and thorium X. These products are in turn unstable. They throw off α particles, and in the case of thorium an emanation results. The radium atom throws off an α particle or α particles, and yields at once the emanation.

The emanation also represents an unstable condition. It throws off α particles and yields a radioactive solid, which, when deposited upon non-radioactive matter, induces in it radioactivity. This solid, or emanation X, or radium A as it is termed, is also unstable and undergoes further transformations. In the case of radium a number of steps have already been traced. In the earlier stages of the transformations of emanation X either α particles or no radiations escape. When no radiation is given out and we still have a well-marked transformation taking place, it simply means that the parts of the atom are undergoing *rearrangement* without losing any constituent.

The β and γ rays are given off only in the *later stages* of the decompositions that are taking place in the radioactive atoms.

These unstable atoms, which are thus undergoing change, are termed by Rutherford *metabolons.*

THE TRANSFORMATIONS OF THE RADIOACTIVE ELEMENTS DIFFER FUNDAMENTALLY FROM ORDINARY CHEMICAL REACTIONS.

The question that would at first arise is this: Are the changes that are going on in the radioactive elements anything different from chemical reactions? New substances with different properties from the original substances are being formed. Energy in the form of heat is liberated, and these changes are characteristic of ordinary chemical transformations. If we study more closely the transformations that are taking place in radioactive matter, we will find marked differences between them and chemical reactions.

In the first place, the changes in radioactive matter take place at a *definite rate, which is entirely unaffected by conditions.* We have studied a number of such radioactive changes, which go on at the same rate at the temperature of liquid air as at a red-heat. This alone would show that the transformations in radioactive matter are fundamentally different from chemical reactions. The latter, as we well know, are greatly affected by conditions, and especially by temperature. The velocity of chemical reactions is in general greatly increased by rise in temperature, and at very low temperatures becomes extremely small or entirely disappears.

Again, the velocity at which radioactive changes take place is very small indeed. The amount of uranium transformed

into uranium X, or thorium into thorium X, or radium into the radium emanation, in any finite time, is very small indeed. In fact, so slight that it can not even be weighed until larger amounts of radium are obtainable. It has been calculated that radium will transform half of itself in about 1,500 years. The loss, therefore, can scarcely be detected during the time over which measurements of radioactivity have extended.

URANIUM AND THORIUM UNDERGO MUCH SLOWER TRANSFORMATIONS.

That radium is, however, undergoing decomposition is certain, and if it were not being produced in some way, all of the radium now in existence would eventually disappear. That radium is being continually produced, probably from uranium, has been made probable. Another marked difference between the transformations that are taking place in radioactive matter and chemical reactions, is in the amount of energy set free. We have already become familiar with the fact that radium liberates quantities of energy incomparably greater than any other known substance. If we compare the amount of heat set free when the most vigorous and exothermic chemical reactions take place, with that liberated by salts of radium, the former is utterly insignificant.

We must, therefore, abandon any attempt to explain the transformations of the radioactive elements on the basis of chemical reactions. The two processes take place according to different laws. They are affected differently by change of conditions. They yield different products, considered both from the standpoint of matter and of energy. In a word, they are fundamentally different processes.

It is one thing to point out that radioactive processes are not chemical reactions; it is a different problem to find out the nature of the transformations that are taking place in radioactive matter. That we have a satisfactory suggestion to account for these transformations will now appear.

THE ELECTRON THEORY OF J. J. THOMSON AS APPLIED TO RADIOACTIVITY.

It would be difficult to account for the instability of the chemical atom on the older theory that a chemical atom is a homogeneous, indivisible unit. In terms of the modern theory of the atom advanced by J. J. Thomson, we can readily see how an atom could be unstable and send off particles, just like the radioactive atoms do.

In terms of this theory of Thomson, which we have called the electron theory, a chemical action, as we have seen, is made up of a large number of electrons, or negative electrical charges, moving within a sphere of uniform positive electrification. The particles are held in their relative positions by their mutual attractions and repulsions. The heavier atoms contain a larger number of electrons than the lighter atoms—the number in any atom being expressed by the atomic weight of that atom in terms of hydrogen as unity, multiplied by 770.

We can easily conceive of some of the electrons, in their rapid movement, coming into such a position that they would escape and fly off from the atom into space. This would be especially the case with the *heavier atoms,* which represent very complex systems of electrons. From such highly complicated systems we might expect a more or less *constant* escape of such particles.

Again, we might not only expect individual electrons to escape from the atom, but *groups of electrons.* Indeed, such groups of these negative electrical charges would be more likely to escape from the atom than single charges.

The facts of radioactivity are in perfect accord with the above conclusions. It is the atoms of largest mass that are radioactive. Thorium has an atomic weight of 232.50, uranium of 238.5 and radium either 225 or more probably in the neighborhood of 256 or 258. *No radioactive substance is known having a small atomic weight, and all of the heaviest atoms are radioactive.*

In the earlier stages of radioactive change it is the α particles that are shot off. The α particles have a mass probably about twice that of the hydrogen atom. This means that they are groups of about twice 770 electrons, that are shot off from the radioactive atom. The atom, having lost this comparatively large number of electrons, is different in nature from the original atom. The system is not yet stable, and another α particle or complex group of electrons is shot off, and another condition of the radioactive matter established. This may continue through several stages, until after a while the *individual* electrons begin to come off as the β particles. It will be remembered that the γ rays are set up as the result of the β rays impinging upon solid matter.

Thus we see that the theory of matter advanced by J. J. Thomson, and which was developed at some length in the earlier chapters of this series of papers, enables us to account rationally for many of those remarkable phenomena which we have studied under the general head of radioactivity. Further, it is the only theory that has thus far been proposed, which enables us to deal at all satisfactorily with this subject.

IS MATTER IN GENERAL UNDERGOING TRANSFORMATION?

The raising of such a question would, until a few years ago, have been regarded as extraordinary, since the elements were regarded as stable and unchanging. In the light of the recent investigations with the radioactive elements, it is most pertinent. We have seen that there is some evidence that all the elements are radioactive to a very slight extent. If this should be proved to be due to the elements themselves, to be a property inherent in all matter and not caused by the deposition of some form of radioactive matter, then, from what has been said above, we must regard matter in general as undergoing change. This change is slow, very slow, but is progressing continuously; the more complex, unstable forms breaking down into simpler aggregates of electrons.

Again, the question has been raised as to whether the general manifestation of radioactive phenomena is necessary to our conception of an inorganic evolution from the more complex to the simpler, which would be exactly the opposite of organic evolution, which tends to build up the more complex.

A reasonable answer seems to be that it is not necessary. We may have changes going on in matter without the expulsion of charged particles like the α particles, or of isolated negative charges like the β particles. If, however, such changes exist we have no means at present of detecting them, and their existence is at present a pure speculation.

If it should be shown that all matter is slightly radioactive, as seems not improbable, then we would be forced to the conclusion of the general instability of the chemical elements. However this may prove to be, enough has already been established to show that our former conceptions of the nature of the chemical element must be fundamentally modified.

New Young Men's Christian Association Railroad Department of the Erie Railroad.

On Monday, January 15, the new Young Men's Christian Association railroad department of the Erie Railroad was opened at Susquehanna, Pa., in the remodeled rooms of the passenger station. The Erie Railroad has given $5,000 for remodeling the building and citizens have raised $2,500 for equipping it, making it an attractive place for the railway men to rest.

Northwestern Electrical Association.

Fourteenth Annual Convention, Chicago, Ill., January 17 and 18, 1906.

THE fourteenth annual convention of the Northwestern Electrical Association was held at the Great Northern Hotel, Chicago, Ill., January 17 and 18. Most of the delegates arrived Wednesday morning, January 17. A fine literary programme had been arranged and there was an auspicious gathering and intermingling of delegates in the lobby of the Great Northern Hotel before the opening session. On Wednesday evening the delegates attended the Great Northern Theatre, the play selected being "Busy Izzy's Vacation," the comedian wearing very prominently the badge of the association on the lapel of his several costumes. All during the electrical show, which was held at the Coliseum, January 15-27, the Northwestern badge was to be seen, many of the delegates being present through the two weeks of the exhibition. While the official banquet was eliminated, there were several banquets, impromptu and otherwise. There was at all times in evidence a rare spirit of good fellowship and besides the electrical show the delegates enjoyed many visits to places of peculiar interest in the "Electric City."

The convention was called to order by President C. H. Williams, who delivered the annual address. He spoke of the special arrangements which had been made to have all papers distributed in advance in the hope that a good discussion would thus be secured. President Williams expressed himself as opposed to the appointing of general committees, as seldom was good work secured in this way. No committees should be appointed, except when a specific duty was assigned to them. He referred to the campaign now going on for increasing the sale of current. The results of the work so far done show that the public is coming to realize the advantages of electric power.

President Williams referred to the poor work that is sometimes met in house wiring, and said that he believed a large part of the trouble which central stations encounter is due to this course.

The report of the committee on legislation was submitted by Chairman S. B. Livermore. Nothing had been done by any of the state committees, except that of Wisconsin. The secretary read a report from President Williams, as chairman of the Wisconsin committee. During the session of the legislature all bills presented were watched by this committee, and when any one had a bearing on the electrical industries copies were secured from the printer and distributed to all interested in the matter. In this way they were able to act in time to prevent injurious legislation. The association tendered a vote of thanks to President Williams and his committee for the valuable work done by them.

A motion was made by Mr. R. N. Kimball, of Kenosha, Wis., that a committee be appointed to look after legislative business. It was suggested that agents might be employed in various state capitals to keep the electrical associations informed concerning all bills bearing on the electrical industry, the expense of this to be borne by the various state associations. The motion was referred to an executive committee consisting of J. H. Harding, W. H. Winter and I. P. Lord.

The first paper of the convention, entitled "The Proper Handling of Consumer's Meters," by Mr. George A. Barrett, was read by Mr. I. P. Lord, of Waupaca, Wis. Mr. Barrett gives instructions for handling and installing meters. These should always be tested after being received, the manufacturer's test not being deemed sufficient. Particular care should be taken in selecting a place for the meter and in handling it carefully when putting it up. Inspection should be made regularly, particularly of commutator meters. Complaints from consumers must be taken up with consideration, and it is well in such a case to make a test of the meter in the consumer's presence, which can be done by turning on and off lights and thus convincing him of the accuracy of the meter. He should also be shown how he can make such tests for himself. The growing custom of giving meter readings in kilowatt-hours instead of watt-hours offers some chance for confusion. In some cases an error in the constant leads to serious error in the bills submitted.

The discussion was opened by Mr. W. H. Winter, of Darlington, Wis., who detailed the experience which his company had had in changing over from a flat rate to the meter basis. Much opposition was encountered among the consumers. Instances were given showing how both the company and the consumer were benefited by the change.

Mr. John Wright, of Antigo, Wis., emphasized the suggestion made by Mr. Barrett regarding the regular inspection of meters and asked whether any had had experience with meters placed out of doors.

Mr. B. C. Adams, Madison, Wis., agreed that direct-current meters should be inspected and tested often. Alternating-current meters are less subject to changes in their constants and need not be tested more than once a year. He thought, however, that the meter should be tested in the shop and not on the consumer's premises, though the latter should be invited to watch the test.

Mr. R. N. Kimball, Kenosha, Wis., said that considerable time had been saved the meter readers by placing the meters in the basement instead of on the second floor of buildings. He suggested that to avoid the confusion due to reading in watt-hours and kilowatt-hours that the hand of the last dial be removed.

Mr. John H. Harding, La Porte, Ind., had found it of considerable advantage to remove the watt hand from the watt-hour dial, thus making all meters read in kilowatt-hours instead of watt-hours.

Mr. Winter objected to this practice, because of the assistance of the watt-hour hand in testing meters, particularly when the consumer tests it himself.

Mr. Adams thought that the consumer should let his meter run long enough so that he could make a test without the watt-hour hand.

Mr. Ernest Gonzenbach, Sheboygan, Wis., thought that the large figures appearing on the faces of meter dials were an objection.

Mr. Adams said that the frequency of inspection of direct-current meters varied considerably with the location of the meter. In gas works, flour mills and other similar buildings frequent inspection is essential. Alternating-current meters are not affected by such surroundings.

Mr. Lord stated that his company had changed over from the flat rate to the meter basis, with satisfaction to both itself and the consumers.

Mr. B. C. Dinius, Zion City, Ill., replying to a question, said that he had one meter exposed to low temperatures. It was placed in a transformer house and gave considerable trouble. He found it necessary to check it twice during the winter and once during the summer. Cold weather makes it run slow. His company has had some trouble with meters where flat-irons and other small household appliances having inductive windings are employed. The effect of these devices is to slow down the meter and sometimes to stop it entirely, even though a lighting load be on at the time. These are alternating-current meters.

WEDNESDAY AFTERNOON, JANUARY 17.

During the afternoon session Mr. P. H. Korst, Janesville, Wis., read his paper entitled "Suggestions for Increasing the Power Output of Central Stations." He spoke of the various methods of charging for current, holding that a simple rate of so much per kilowatt-hour is not satisfactory. He urged the employment of solicitors for securing new consumers. Frequently he found it necessary to install motors for desirable consumers for a few months on trial in order to convince them of the desirability of this power. Judicious advertising always pays. The newspaper is a good medium. The wording should be changed frequently. Illuminating signs assist in securing new customers. There are many opportunities for using motors as yet undeveloped. Residences offer a large field for increasing the sale of current. An advantage of this character of service is that the load comes during the day and on holidays when the station load is usually low. Mr. Korst

gave a list of industries where opportunity offers for introducing motors.

Mr. H. Almert, Oak Park, Ill., said that the increased use of electric current for power and other purposes is merely a question of the education of the public, but before this could be done it is often necessary to educate the central station man. Not infrequently the latter is very ignorant of the possibilities of applying electric power. The large power companies have learned better and go after customers, but the small station in the little town or village seems to wait for the customer to come to it. These companies should first organize themselves thoroughly and then go out for new business. The manufacturers of electrical apparatus are doing a good deal to aid the central station man.

Mr. L. W. Burch, Madison, Wis., said that frequently a stranger to a town can secure more business than a resident because the former takes nothing for granted.

A brief discussion took place regarding the advisability of discarding old high-frequency apparatus, Mr. Harding holding that where a lighting load only exists the high-frequency apparatus is not at a disadvantage.

Mr. G. H. Lukes, Evanston, Ill., spoke of the need for more data on the cost of operating various machines by electric motors. He mentioned a case where a firm of consulting engineers estimated that a forty-five-horse-power motor would be satisfactory for a mill, but afterward had been forced to take it out and replace it by a ninety-horse-power machine.

Mr. Kimball spoke of the tendency in certain establishments to install one large motor for running the shafting on several floors rather than a number of smaller machines in order to keep down the first cost. This practice is, of course, bad.

Mr. W. W. Bean, St. Joseph, Mich., referring to Mr. Harding's opinion regarding high-frequency apparatus, said that on an investment of $10,000 or $20,000 the old apparatus could be discarded and newer, improved installed, the saving thereby effected paying at least for the increased investment.

A paper was read by Mr. W. D. Burford, La Crosse, Wis., entitled "Modern Underground Construction." Mr. Burford described the new distribution system of his company at La Crosse. The power-house is located two miles from the centre of distribution. The transmission line, which is three-phase, 2,300-volt, sixty cycles, is carried on poles for two miles to the point where the conduit begins. The conduit is constructed of McRoy glazed, vitrified clay, containing four to six ducts. A trench is first dug and then a treated two-inch by twelve-inch hemlock plank is laid. On this, two-inch by two-inch by twelve-inch hemlock cleats are spaced so as to bring them four inches away from each joint. The conduit is laid on the cleats, the joints between the two sections wrapped with a piece of muslin strip four inches wide, saturated in water. An iron mould is slipped down the side of the conduit, forming a space eight inches long by two inches wide around the joint. This is filled with Portland cement. Then two more cleats are placed on top of each length of conduit, and four inches away from the joint, and the space between them filled with cement. The whole is then covered with a two-inch by twelve-inch hemlock plank. As the work progresses a mandril is drawn through the duct, so as to bring them into line, should this be necessary, and to draw out any obstructions which might fall in.

The type of manhole was described and the method of carrying lateral pipes from the manholes to the distributing poles. Paper-insulated cables are used and particular care is taken in drawing them into the conduits and in splicing. A pothead is placed on the top of each distributing pole, which makes it possible to seal the end of the cable hermetically and to carry out the conductors conveniently. The sheathing of all the cables in each manhole is bonded together, and at a point near the power-house of the street railway company a return conductor is carried from the cables to the grounded side of the generators. Figures were given of the cost of laying this type of conduit, the cost of conductors and of making splices.

Mr. C. B. Springer, of the Chicago Edison Company, in discussing this paper described briefly the system of conduits used by his company. He said that where streets are frequently torn up it is advantageous to place protecting planks on the sides of the conduit as well as on the top. He also gave estimates of laying conduit with various classes of pavement. Mr. Springer also described a particularly difficult piece of conduit-laying in water and running sand, where surface water was found within a foot of the street surface. Trenches were dug in sections of fifty or seventy-five feet in length and sheathed with matched lumber. The trench was pumped out and concrete laid in dry over night. This gave a hard bottom. The trench was again pumped out and rather dry concrete used in building up the sides. This gave a thoroughly satisfactory job.

Mr. Lukes referred to the tendency to force wires underground, even in small towns. Frequently the great cost of this construction is prohibitive, so that a cheaper method becomes desirable. For temporary conduits he has used sewer pipe with cement joints, which has proved satisfactory.

Replying to a question by Mr. G. Cutter, Chicago, Ill., regarding the method of carrying out wires from conduits to arc lights, Mr. Lukes said that his company employs rubber-covered lead cables from the manhole to the top of the pole. No switch is used, but potheads are placed on the pole.

Mr. H. B. Gear, of the Chicago Edison Company, described briefly the pothead used by that company. An important feature of this pothead is the porcelain sleeve which is slipped over the conductor in place of the old lead sleeve. This tube is about one and one-quarter inches inside diameter and ten inches long. The lower portion is brought together so that it is just large enough to let in the cable. On the top of the tube there is a cap very much like an ordinary line insulator, with a tapering top and a petticoat overhanging. This prevents rain from beating into the tube. The tube is placed over the cable, the lead from which has been stripped back so that not more than two inches will come into the tube from the bottom, thus leaving a space of two or three inches between the lead and the live conductor. A screw connection is provided for attaching the line wire to the cable.

Mr. Almert emphasized the necessity of preventing moisture from collecting in the tube, where it may freeze around the cable, thus crushing it and causing a short-circuit.

Some discussion took place regarding the proper location of cutouts. A good deal of trouble has been encountered, particularly when the switch is placed in the bottom of the pole. Mr. Almert now uses a cutout made entirely of porcelain. These have given no trouble.

President Williams referred to the difficulties sometimes encountered where the compound used to fill the sleeve for making a splice softens and falls out.

Mr. Burford has met with the same trouble with cables passing through a room where they are exposed to great changes in temperature. He has never secured a satisfactory explanation.

A paper by Mr. George Williams, of Madison, Wis., entitled "The Organization and Development of New Business Departments," in the absence of the author was read by Mr. Kimball. Mr. Williams says that no city in this country is yet properly illuminated. Less than ten per cent of the total number of residences connected use light without stint. This is due to the ignorance of consumers who fear overcharging or do not appreciate the benefits of the supply. There is a wide field for extending the use of electric power wherever steam is now employed. To do this the central station company should first form an acquaintance with the various trades which it wishes to supply. It should then bring to the notice of these trades the possibilities of using electric power. Great courtesy must be used at all times, and the company itself should set the example in using power and light. Advertisements should be placed in the daily papers and no opportunity be neglected of bringing to the attention of the public the advantages of electric power. He emphasized the need of having a well-appointed office, which should be kept open and brightly illuminated at least until midnight.

This paper was discussed at some length by Mr. Almert, who marveled, he said, at the lack of enthusiasm and progressiveness of the average small central station manager. Because his services is the subject of talk by city councils and politicians the central station man avoids publicity at all times. This is wrong, for no opportunity should be neglected to

bring his product before possible consumers. A well-equipped office should be provided on a main street and a display made of various electrical appliances. This display should be changed frequently so as to attract attention. The city should be divided into sections and canvassed to determine its possibilities. Accurate records should be kept, using a card system. To make a sale the central station man must first obtain an introduction, either personal or by letter, and must create a desire in the prospective customer for what he is offering for sale. He must then adjust what he offers so as to meet the particular needs of the customer. Having once obtained an interview, the follow-up system must be adopted. The only way to make a success is to keep at it constantly.

Mr. Frank B. Rae, Jr., Newark, N. J., described some interesting experiences which he has had in his work of organizing and pushing sales of electric power. He is in favor of personal solicitation, the use of letters and newspaper advertising. The main trouble with half of the central station newspaper advertising is that it deals in glittering generalities. This is a mistake. A carefully thought-out campaign must be planned which will cover the entire field, but do it a step at a time. The advertisements in the daily papers must be changed at every issue. The whole advertising idea is simply one of education, and it must be primary education. The arguments must be couched in simple language which every one can understand. Mr. Rae believes that a local newspaper in a small town gives good results.

Mr. Adams said that good results had been obtained by sending out solicitors with definite propositions.

Mr. T. G. Grier, Chicago, Ill., believes that advertising in a local newspaper is beneficial as a means of promoting good public opinion, even though it does not produce direct results.

Mr. Gonzenbach's company has tried the methods of getting new business suggested by Mr. Williams, with good results. There is, however, one class of service which is not profitable—that in which there is but occasional use of current.

THURSDAY MORNING, JANUARY 18.

The discussion on Mr. Korst's paper of the preceding day was reopened by Mr. F. M. Kimball, of the General Electric Company. He spoke of the value of obtaining an entrance into a residence, even if only for a single light. This always leads to more business. He held that the central station people throughout the country have not yet begun to awake to the possibilities that lie before them. They have secured already a good part of the evident business and have made a start into a class of business not quite so apparent, such as the use of small motors in groceries and other similar establishments. A third class of business is that of displacing other power in a long-established concern. In this field there is a great possibility. It is important in soliciting business never to be refused. If the prospective customer is not interested, leave him and wait a more favorable opportunity. Mr. Kimball spoke of the great possibilities of development in the Middle West, as the manufacturing centre is rapidly moving in that direction.

Mr. C. J. Davidson, in a paper entitled "Government Tests on Fuel," described the tests conducted in 1904 at the St. Louis Exposition. The paper was discussed by Mr. Edward H. Taylor, Chicago, Ill., who spoke briefly of the advantages of obtaining coal on a fuel specification, paying only for the amount of heat available.

Professor W. B. Jackson spoke of the value of buying fuel in this way, and of keeping records showing just what the plant is doing each day.

Mr. R. N. Kimball questioned whether it was proper to rate the performance of a plant according to the number of thermal units per kilowatt generated. He thought the amount of water evaporated per pound of coal was a better figure.

A paper by Mr. John S. Allen, entitled "The Proper Handling of the New Business Department," was read. He divided the subject into three parts: the salesmen, advertising, and rates. Too much care can not be taken in selecting suitable salesmen. They should be thoroughly educated in the advantages and uses of electric current. The daily newspapers are of value for advertising, and such advertising should be done in an attractive manner. Mailing-cards and circular letters are also of assistance. Rates should be made attractive, but should not be so low as to cause loss.

The paper was discussed by Mr. Rae and Mr. Korst. The latter spoke of the advantages of getting a start. His company had been very successful in installing porch lights at fifty cents per month. This almost always led to the use of lights in the house.

Mr. G. D. Westover, Cadillac, Mich., said that his company has met with considerable success by making every man in its employ a solicitor, crediting him either with a commission or with credit for part of a day when he secured new business.

Mr. Kimball cautioned against paying solicitors a commission only, as they are apt to sell apparatus for which the customer has no need.

President Williams described the method used at Madison, Wis. The town is divided into territories, each in charge of a solicitor with assistants. They are paid a salary and a percentage on the new business.

Mr. Lukes thought it better to pay the solicitors a commission on the increase of business rather than on the sale of appliances, as is done in some cases.

The report of the committee on nominations was presented, and, on motion, the secretary cast the ballot for the nominees. They are as follows: president, H. Almert, Chicago, Ill.; first vice-president, E. B. Kirk, Oshkosh, Wis.; second vice-president, Frank Baker, Evanston, Ill.; secretary and treasurer, B. C. Adams, Madison, Wis.; directors, Irving P. Lord, Waupaca, Wis.; C. H. Williams, La Crosse, Wis.; Roger N. Kimball, Kenosha, Wis.

The committee suggested that some suitable token be presented to Mr. Thomas R. Mercein, the retiring secretary, for his good work.

Messrs. Gonzenbach and Harding were appointed a committee to conduct the new president to the chair.

A vote of thanks was extended to Mr. Williams for the earnest work which he had done for the association during his presidency.

The suggestion of the nominating committee was adopted and a committee appointed to secure a token for Mr. Mercein.

At the suggestion of Mr. Kimball a committee was appointed to consider the suggestions made in the retiring president's address.

THURSDAY AFTERNOON, JANUARY 18.

The president announced, as a committee on the retiring president's address, Ernest Gonzenbach, R. N. Kimball and E. B. Kirk.

A paper was presented by Mr. Gonzenbach on "The Economy of Combined Railway and Lighting Plants." Mr. Gonzenbach calls attention to the advantages of combining stations of this kind, and thus securing a better load-factor. He described a station of this character for a city of about 40,000 inhabitants. The combined station would cost about $340,000. It would consist of an installation of 1,500 kilowatts, which allows about twenty-five per cent reserve. In this way a considerable saving in first cost is secured and the operating expenses are decreased. The plant contemplates supplying light and power from the same generator.

Mr. Korst said that his station sells power to a local railway. It has two 250-volt generators supplying light on the three-wire system, and a 500-volt generator for the railway work. During the greater part of the day the two 250-volt machines are run in series, supplying light and the railway load, but the peak of the railway load is carried by the 500-volt machine.

Mr. J. M. S. Waring referred to the conditions in Peoria, Ill., where there is a varying power-load which brings a heavy peak on the station. This has been met by the installation of a battery. In Milwaukee a combined railway and lighting station has installed a battery which carries both the railway and lighting loads. End-switch regulation takes care of the lighting variations, and an automatic booster, of the railway changes.

Professor W. B. Jackson, while admitting the advantages of a combined station, did not believe that the power-factor could be raised from thirty-three to fifty per cent, as claimed by Mr. Gonzenbach. He thought also that the plant, as outlined by Mr. Gonzenbach, was cut a little too

close. He referred to a station in Berlin, where 550-volt generators are used for the railway load and the same machines are operated at 440 volts for the lighting service. This company divides the voltage by means of a battery so as to enable it to use 210-volt lamps.

Mr. Gonzenbach explained the application of the plan, as outlined in his paper, to a combined plant in Sheboygan, Wis. There are here two direct-connected, 500-kilowatt alternators connected to separate engines. There are two smaller high-speed engines, one driving an alternating-current and a direct-current machine, and the other driving a direct-current machine only. By means of the two machines connected together it is possible at any time to throw a direct-current load on the large alternating-current generator, or vice versa.

A paper by Mr. R. N. Kimball, on "The Effect of Load-Factor on Station Costs," was presented. Mr. Kimball analyzes the various losses and expenses of a system, showing how each bears upon the cost of the power.

On Friday an executive meeting was held and the convention was adjourned.

CHANGES IN TELEPHONE RATES AND MANAGEMENT.

OPINION OF MR. U. N. BETHELL ON CHARGES AND DOUBLE TELEPHONE SERVICE.

Mr. U. N. Bethell, general manager of the New York Telephone Company, made the announcement January 19 at a dinner of the Telephone Society in Shanley's restaurant, Broadway and Forty-third street, that the directors of the New York and the New York & New Jersey Telephone companies had decided last week to make a reduction in telephone rates in the metropolitan district. Local pay station rates within the Manhattan and the Brooklyn exchange districts, respectively, will be five cents instead of ten. The new rates will not go into effect before June 1 or July 1, because of the preparations necessary to accommodate the expected increase of business.

Mr. Bethell also announced his own retirement from the office of general manager and said that an important change in the organization of the business in the metropolitan district will go into effect on March 1. This district is served by the New York company, of which Mr. Bethell is now vice-president and general manager, and the New York & New Jersey company, of which he is president. The New York company serves Manhattan and the Bronx and certain outlying territory to the north, and the other company Long Island, Staten Island and the upper part of New Jersey.

In the future, while each of these two companies will retain its separate existence for legal and financial reasons, they will be operated by one general manager with one policy.

Mr. Bethell's announcement was received with great cheering by the 400 men who were present and who represent the employés of the Bell company in this district. The dinner was entirely informal, evening clothes being barred. The reduction of rates, Mr. Bethell said in his address, was in line with the settled policy of the telephone company since his connection with it thirteen years ago.

Mr. Bethell remains president of nine telephone companies and vice-president of the New York company, operating in a crescent-shaped territory stretching from Washington to Syracuse, and centering at New York. Three years ago he put the five-cent rate in operation in Washington and Baltimore. Two years ago he put it into effect in the Philadelphia region. Last year he put it into operation in the suburban district of New York. As soon as the plant in Manhattan and Brooklyn can be made ready it will go into effect here.

Mr. Bethell recalled that when he took charge of the system in New York there were only 9,704 telephones in Manhattan and the Bronx. Now there are more than 175,000. He has helped to put the wires underground, has seen the installation of the metallic circuit service, the change from the magneto to the common battery system of working and has seen the growth of the private exchange system so that all of the principal hotels now have telephones in every room. When he took charge the flat rate for a telephone was $240 a year. Now each subscriber pays for what he gets, under a graduated scale varying with the facilities provided and the amount of service rendered.

Mr. Bethell said that under the new system of operation for the metropolitan territory the general manager would be in general charge, with the traffic, plant, business, supply and building departments reporting to him. There will be one chief engineer and one general manager for the district, which will include Manhattan, the Bronx, Brooklyn, parts of Westchester and Rockland counties, Jersey City, Newark, Elizabeth, Paterson and tributary territory. Subject to approval by the board of directors of the various companies these official changes were announced:

While W. D. Sargent retains the position so long and honorably held as vice-president of the New York & New Jersey Company, J. C. Reilly, formerly general manager and a very progressive telephone man, will also become vice-president of that company. J. J. Carty will be chief engineer and H. F. Thurber general manager of both companies operating in and about New York. Theodore Spencer will be vice-president and general manager of the Bell Telephone Company, of Philadelphia; F. H. Bethell, vice-president and general manager of the Chesapeake & Potomac Company; H. F. Stevens, vice-president and general manager of the Central New York, and H. E. Hawley, vice-president and general manager of the Hudson River company.

The dinner was presided over by J. S. McCulloh, president of the Telephone Society.

After stating that the number of telephones in the territory served by the companies with which he is connected is now about 600,000—more than in Great Britain and France combined, Mr. Bethell said:

"In the figures which I have given you as to our territory I have included Bell telephones only. I have done that intentionally, not that I wish to ignore the fact that there are some other telephone companies operating in certain parts of that area, because I do not wish to close my eyes to that fact, or to ask you to close your eyes to that fact, but I believe as surely as I stand here that the public will not tolerate for any great length of time the operation in any great city of two telephone companies, because of the vast annoyance and the double charges incident thereto. There is only one possible advantage in telephone competition from the standpoint of the public—it may have a tendency to make the older company more watchful of the public interest. Now, the New York Telephone Company has, I believe, during the whole of my connection with it, for thirteen long years, conducted its operations and its business with respect to expansion, efficiency and charges as if it had a competitor on the same block around the corner. I do not believe that that policy will be changed one iota because of any threatened competition. This broad policy, I believe, permeates our whole system, a policy of recognizing our duty to the public and endeavoring to follow and conscientiously carry out that duty, and I trust that when we forget that duty neither you nor I may be connected with the telephone industry."

Other speeches were made by C. F. Cutler, president of the New York Telephone Company; Theodore Spencer, J. J. Carty, J. C. Reilly, H. V. Hayes, H. S. Snow, F. H. Bethell, H. F. Thurber, S. L. Gilman and H. G. Bates.

First Annual Show of the Electrical Trades Exposition Company.

The Coliseum, Chicago, Ill., January 15-27, 1906.

THE first annual show of the Electrical Trades Exposition Company will go down in history as one of the greatest and most successful events in the development of electrical achievement. The exhibition opened on Monday evening, January 15, continuing for two weeks until Saturday, January 27. A wireless message from President Roosevelt, "Congratulations and best wishes," was the signal for the turning on of the lights and the starting of the machinery in the great auditorium. Fully 10,000 people were present at the opening, the attendance averaging 8,000 each succeeding day.

The very intelligent interest shown by the visitors was sufficient to compensate for the representations prepared by the various exhibitors, and in many instances the announcement has been made that the direct results have been so evident as to satisfy every expectation.

The dominant feature of the show was the educational expression of each exhibit. In addition to this, however, the spectacular was very much in evidence, and with the giant revolving, flashing star, built by Egbert Reynolds-Dull, the lectures and experiments of W. J. Clarke and the demonstrations of C. H. Thordarson, the public had left little to demand in the line of amusement.

The American De Forest Wireless Telegraph Company received and transmitted "aerograms" in a finely appointed booth, the crackling of the electric spark and the modern wonder of the apparatus attracting much attention.

The Chicago Edison Company and the Commonwealth Electric Company made a comprehensive and instructive exhibit, planned to present the various useful applications of central station energy to light, heat and power purposes. A complete electrical kitchen was fitted up, many samples of electrically cooked food and beverages being handed to the visitors. The advantages of electric lighting and heating in every room were set forth, and in the power department a printing-press and folding machine, motor driven, issued a daily edition of the "Electric City."

The Chicago Telephone Company occupied a large booth in the centre of the hall, every booth in the building being connected to this "central." A very large amount of local business was constantly handled and the direct lines to all the large cities were also kept busy.

The spectacular feature of the exhibition was the large flashed, revolving star, built by Egbert Reynolds-Dull. This star was twenty-five feet six inches in diameter, weighed 650 pounds and was equipped with 314 incandescent lamps, ranging from 100 to four candle-power, with frosted white and colored bulbs. Various combinations of circuits were continuously flashed on and off, while the star revolved like a great pinwheel about eighteen times a minute.

An exhibit of several technical institutions in "College Row," including work done by the students and a display of various instruments, was made by Purdue University, the University of Wisconsin and the Armour Institute of Technology.

An historical exhibit, loaned by Charles E. Gregory, president of the Guarantee Electric Company, Chicago, which attracted a good deal of attention, was the first electric light plant installed in Illinois. This was the Sawyer-Man system, manufactured in Middletown, Ct., 1878-'79, by the Electro-Dynamic and Light Company. It was exhibited at the *Inter-Ocean* office, 119 Lake street, Chicago, September, 1879, and was installed in the store of J. V. Farwell, October, 1879. A company, capitalized at $2,500,000, was organized by Henry Tanner, of New York, to own and exploit the system in Illinois, and this company paid $50,000 in cash for the Illinois rights.

The data from the original catalogue state that the dynamo is "series wound, hand-oiler; capacity, twenty 100-candle-burners; shaft hollow, to permit water to pass through for cooling purposes." The original voltage of the lamps is unknown. The lamps on exhibition take thirty amperes at ten volts for incandescence. The globe is charged with nitrogen, exhausted and hermetically sealed. The carbon pencil feeds upward through a carbon block to the disc automatically. The guaranteed life is 400 hours and the pencils can be renewed. The candle-power can be raised or lowered by changing the length of the pencil. The luminous intensity was claimed to vary from 100 to 1,000 candles. H. H. Edgerton, gas expert, has certified that the candle-power obtained equaled twenty-seven sperm candles.

The Ackerman-Boland Telephone Company, Chicago, Ill., exhibited a complete line of intercommunicating telephones. Represented by C. N. Ackerman.

The Acorn Shade and Reflector Company, Chicago, Ill., exhibited window and show-case reflectors, art shades and portable lamps. Represented by W. L. Benson and G. R. Benson.

The Allis-Chalmers Company, Milwaukee, Wis., made a striking exhibit of power machinery and electrical apparatus. This included a twenty-five-horse-power, direct-current Bullock, type "N" motor, driving a sixty-kilowatt, belted Bullock alternator, generating current for a line of Bullock induction motors ranging in capacity from two horse-power to thirty horse-power. There was also exhibited a ring from a 1,500-kilowatt steam turbine, and a section of blading from one of the 5,500-kilowatt turbines now building at the West Allis shops, and also samples of smaller capacity. A large assortment of small motor and generator parts, including punchings and insulated coils, was also displayed. Two show-cases were arranged with the files of the electrical and power bulletins of the company. The company was represented by S. R. Kerr and C. A. Tupper, from the Milwaukee office, and these gentlemen were assisted by the following salesmen from the Chicago office: C. L. Brown, C. S. Buell, E. Dryer, P. H. Carey, J. V. Redfield, F. G. Whipple, J. W. Denniston, H. Branch, C. A. McDonald and J. W. Gardner.

The American Bank Protection Company made an elaborate exhibit of protective electrical signals for safes, offices and bank vaults.

The American Circular Loom Company, Chelsea, Mass., fitted up a cozy reception and lounging room. Represented by Harry B. Kirkland, M. F. King and P. E. Reiners.

The American Conduit Company, Chicago, Ill., exhibited a number of samples of bituminized fibre conduit. A feature of this exhibit, which attracted a great deal of attention, was the line entrance for high-potential transmission work. Represented by A. L. Waterbury.

The American Electric Fuse Company, Muskegon, Mich., exhibited a line of "Kaisling" self-soldering protectors, the Allen-Bradley crane controller, fuse blocks, pole terminals, connectors and specialties. Represented by Frank G. Jones, P. G. Jones and G. W. Redormer.

The American Electrical Novelty and Manufacturing Company, New York, N. Y., exhibited a line of flash-lights, clock-lights, "Sarco" aluminum reflector, and "Sarco" Midget push-button switch and other specialties. Represented by Alfred J. Jackson.

The American Electric Sign Company, Chicago, Ill., exhibited a line of special made-up and interchangeable electric signs. Represented by H. C. Dodge.

The American Electrical Supply Company, Chicago, Ill., exhibited a complete line of supplies, including Fostoria lamps, "Colonial" motors, "International" meters, De Veau telephones, "Sarco" specialties. Represented by F. D. Phillips, vice-president; B. J. Mockenhaupt and E. J. Johnson.

The American Steel and Wire Company, Chicago, Ill., exhibited samples of electrical wires and cables of every description. A striking feature of this exhibit was a huge pole, upon which was wound a mile of copper wire. A pole line, with cross-arms and insulators, was

also erected in this company's booth. The exhibit of rail-bonds and rail-bond material, including two special automatic-feed drills for drilling four holes at once for a new quadruple terminal, and a new twin terminal, attracted much attention. There was also exhibited a new hand-power compressor, doing away with a reverse screw motion; a portable rail grinder, hydraulic tools, samples of steel springs, furniture springs and railroad wire fencing. Represented by B. B. Ayers and George Long.

States, the public exchanges ranging in size from 100 to 20,000 lines.

The Belden Manufacturing Company, Chicago, Ill., exhibited a line of silk and cotton-covered wire, ranging from No. 12 to No. 40; switchboard wire, telephone cords, multiple conductors, braided conductors, terminals and connectors, crude material in copper, cotton and silk, tallow and rosin-cored, self-fluxing solder and a unique automatic-registering winding machine. Represented by J. H. Lendi.

The Benjamin Electric Manufacturing Company, Chicago, Ill., exhibited a fine line of Benjamin wireless clusters. This includes the Benjamin "Arc-Burst" in fixture form, suspension form, ceiling form and weatherproof form. A large tablet showed the various parts of the fixtures and a show-case presented several specialties made by this company. A feature of this display was the "Protectalite" portable lamp socket. This consists of a socket, a jet-enameled handle and a "Can't-Break" lamp guard. The "Can't-Break" lamp guard is made of metal in two parts which hinge over the lamp socket, locking tightly over the tip. The lamp is held, centered and protected from shock by two resilient spring wires. Represented by S. R. Fralich and C. A. Bowen.

The Bryan-Marsh Company, Chicago, Ill., exhibited a sample board showing a line of lamps, including the "Imperial Prismo" lamp and standard and special lamps, ranging from 500 candle-power down to one-half candle-power; frosted and clear, with bulbs from six inches to one-half inch in diameter. Represented by E. H. Haughton, J. L. Barnard, J. S. Corby, "Doc" Sam Furst, F. M. Henkel, R. S. Mason and F. W. Godfrey.

A General View at the Electrical Show, Coliseum, Chicago, Ill., January 15-27, 1906.

Arthur Adam, Chicago, Ill., exhibited a number of electrical inventions of a special nature.

The Automatic Electric Company, Chicago, Ill., exhibited a complete automatic telephone exchange of the 1,000-line type with telephones connected. The perfect operation of this apparatus was a matter of very great interest on the part of thousands of visitors. At no time was it possible for even the large and competent staff of the Automatic Electric Company to entertain all those interested in this device. The system has now been adopted in over seventy-five cities in the United

H. B. Camp Company, New York, and G. M. Gest, New York, made a joint exhibit showing various sizes of single and multiple duct. The Gest adjustable cable rack was also shown, along with a number of excellent photographs showing installations of conduit which G. M. Gest is carrying on in all parts of the country. Represented by W. T. Jackson.

The Central Electric Company, Chicago, Ill., displayed a large number of electrical supplies, including Okonite products, Weston instruments, Warner

pole changers, Williams-Abbott telephones "Alphaduct" flexible conduit, "Reco" flashers, Edison primary batteries, Edison battery fan motor outfit, D & W fuses, Columbia lamps, Keystone die-stocks and pipe reamers, and other specialties. Represented by George A. McKinlock, president; J. W. Mason, general salesman; W. H. Pearl, J. H. Coulter, Charles E. Brown, secretary. F. R. Bryant, advertising manager, installed and was in charge of the exhibit.

The Chicago Battery Company, Chicago, Ill., exhibited batteries, special lamps, headlights, tail lights, dash lamps, searchlights, trouble lamps, gauge lamps and pilot lamps.

The Chicago Compound Battery Company, Chicago, Ill., exhibited the "Compound" primary cell and the "Compound portable primary cell. Represented by B. J. Blaumeuser, president; W. J. Bauerle, treasurer, and Nicolas Kribs, secretary.

The Chicago Lamp and Reflector Company, Chicago, Ill., exhibited a line of handsome electrical lamps and shades, showing some striking designs in leaded glass.

The Chicago Pneumatic Tool Company, Chicago, Ill., exhibited a complete line of air-cooled Duntley electric drills, electric cloth cutters and "Little Giant" storage batteries. In connection with the demonstrations with electric drills considerable interest was created through the introduction of a magnetic "old man" which holds against any metallic surface, enabling the drilling to be accomplished quickly and without the aid of bolts or other cumbersome devices, utilizing the same current to operate the magnet which operates the drill. Every one is more or less familiar with electric magnets, yet when one observes a magnet only six inches in diameter, one and one-half inches thick, lifting 700 pounds, it almost seems incredible, yet this is actually accomplished. The exhibit, as a whole, was very interesting and is made more so by the decorations of the walls of its booth with medals, diplomas and awards received from various exhibitions and universities. The exhibit was in charge of W. O. Duntley, vice-president, and C. E. Walker, assistant vice-president, assisted by Howard Small, C. B. Coates, Geo. H. Hayes, J. G. Sanborn, C. V. Walker, Jr., and Benjamin Rosenheim.

The Chicago Solder Company, Chicago, Ill., exhibited the famous gold clock, constructed entirely of pins, which attracted so much attention at the St. Louis World's Fair. The pins are fastened together with Kester self-fluxing solder.

Frank B. Cook, Chicago, Ill., made a very complete display of protective apparatus, from switchboard protectors to pole-cable terminals. On one large distributing frame were mounted the five different types of Cook's protectors, the earliest type being the No. 4, with tubular coil, and the latest, the No. 8, with self-soldering protector. A novelty in the way of a land-anchor, which bores its way into any depth of earth desired, was also shown. The Cook self-welding wire joints for connecting copper wires attracted much practical attention. Besides these there was shown a line of junction boxes, guy clamps test connectors, subscribers' station protectors, fuse-strips and U-bolt clips.

The Crane Company, Chicago, Ill., showed the latest development in valves and steam specialties. Two of the valves were equipped with electrical devices, by means of which the operation of the valves may be controlled from any point. One of these was an eight-inch, high-pressure, motor-driven, ferrosteel gate valve with the motor attached directly to the valve-rod, and the other was a twenty-four-inch hydraulically operated gate valve provided with an electrical device by means of which admission of water to the operating cylinder is controlled. There were also a twenty-four-inch-vacuum oil separator, an eight-inch, high-pressure, vertical separator, a Cranetilt return and a Cranetilt non-return steam trap, and a number of other steam specialties. Represented by J. A. Minwegen.

The Crocker-Wheeler Company, Ampere, N. J., made a decidedly attractive exhibit under the direction of Julian Roe, Chicago manager. In addition to a line of standard motors, there was exhibited a special variable-speed motor, 535-1,600 revolutions per minute, for machine-tool driving, a twelve-kilowatt, 115-volt exciter and a seventy-five-kilowatt, 2,300-volt, three-phase, sixty-cycle alternator, which is to be installed in the plant of the Geary Electric Light and Power Company, Geary, Okla. The attractiveness of the booth was enhanced by the arrangement of photographs of various installations of Crocker-Wheeler apparatus.

William P. Crockett, Chicago, Ill., displayed a line of specialties, including De Veau intercommunicating telephones, wall sets, desk sets and switchboards, "Diamond H" switches, Keystone electrical instruments, Bossert service boxes, outlets, panel-boards and supplies.

Dossert & Company, New York, N. Y., exhibited a complete line of solderless wire connectors. Represented by E. A. Dossert and J. J. Dossert.

The Edwards Electric Headlight Company, Chicago, Ill., attracted a lot of intelligent attention with its electric headlights for locomotive and interurban railways. These headlights are self-contained units, the turbo-generator being an integral part of the headlight.

The Electric Appliance Company, Chicago, Ill., exhibited a full line of supplies. The new type mercury chamber meter, made by the Sangamo Electric Company, attracted much attention. The exhibit of the meters, working on live circuits, was designed and executed by R. C. Lanphier. The display also included Packard lamps and transformers, "Paranite" wires, "Eaco" telephones, Reynold's flashers and Sachs "Noark" fuses. Represented by J. M. McMullin, H. N. Remington, C. A. McCarthy, S. A. Dinsmore, Edward C. Brown, J. K. Alline, Elmer V. Brown, W. P. Upham, W. W. Low, T. I. Stacey, P. R. Boole, Frank Schwartz and H. E. Sanderson.

The Electric Gas Lighting Company, Boston, Mass., exhibited a line of intercommunicating and signaling systems.

The Electric Storage Battery Company, Philadelphia, Pa., exhibited various sizes of "Chloride" and "Exide" accumulators. The cell that attracted considerable attention was the type R-83 lead-lined tank, containing an R-71 element, with a cell-capacity of 4,200 amperes for one hour. This is a duplicate of the cells to be installed by the New York Central & Hudson River Railroad. There were other cells showing the lead-lined tank, the glass tank and glass jar types. There was also a standard battery switchboard, several car-lighting batteries and an automatic cell-filling device. Represented by G. H. Atkin, Chicago manager; J. M. S. Waring, J. A. White, Irving Seaman and H. B. Marshall.

The Electro-Dynamic Company, Bayonne, N. J., showed an "Inter-Pole" motor driving a generator at fluctuating loads. In this booth there was also exhibited parts of the Moloney transformer. Represented by F. L. Merrill, Chicago manager; F. G. Bell and Francis Raymond.

The Federal Electric Company, Chicago, Ill., exhibited a large line of sectional letters and assembled signs. The feature of this sign is its application to the "free-sign" proposition for central stations. This company distributed a folder containing six letters which, when folded, made up a cube. To the persons creating the greatest number of words out of a set of these cubes various prizes were given. Represented by I. M. Gilchrist, manager; R. B. Francis, assistant manager; G. C. Patterson, advertising manager, and W. J. Devine, city salesman.

The Fort Wayne Electric Works, Fort Wayne, Ind., exhibited a line of prepayment wattmeters, standard instruments, various meter parts, revolving fans, arc lamps and transformers. A "Wood" historical dynamo was also on exhibition. This machine was built in May, 1879, weighs eighty-six pounds and gives from six to nine amperes at fifty volts, 1,700 revolutions per minute. The Shelton Electric Company, Chicago, Ill., also exhibited the Shelton vibrator in this booth. Represented by W. S. Goll, C. E. Searles, A. L. Pond, J. H. Raymond and J. B. Mills.

The General Electric Company, Schenectady, N. Y., had a very elaborate exhibit of electrical apparatus and appliances. The complete cooking and heating display, where demonstrations were continually given, created a very great interest. The mercury-arc rectifier attracted a lot of attention, and another interesting feature was the resident type switchboard. In addition to a line of standard motors and machine-tool motors, there was a motor-driven house pump and an electric hoist driven by a variable-speed induction motor. The exhibit of arc and incandescent lamps was particularly impressive, two large showcases displaying every type and

size of lamp from a "grain of wheat" to the high-candle-power, high-efficiency, metallized filament lamp. The new "metallized" filament lamp with special reflector was also shown. Circuit-breakers, rheostats, controllers, measuring instruments, a curve-drawing voltmeter and a smaller apparatus were also shown. A feature which created a good deal of amusement was the biograph pictures of the race between an electric locomotive and a steam locomotive, and scenes at the Schenectady works of the company. The exhibit was opened by F. H. Gale, advertising manager, and the company was further represented by P. D. Wagoner, F. G. Vaughan, A. D. Page, F. W. Willcox, H. C. Wirt, F. W. Kimball, W. F. O'Connor, Darwin Ulke, P. A. Rogers, E. L. Callahan and a corps of agents from various parts of the country. In another section of the exhibition hall a horizontal Curtis turbine operating a twenty-five-kilowatt alternator for arc light service was under the direction of F. E. Semple. This unit attracted a great deal of attention.

The General Storage Battery Company, New York, N. Y., exhibited various types of the "Bijur" high-duty storage battery, a charging generator, a main switchboard, a yacht-lighting switchboard, a constant-current booster and a yacht-lighting battery. Represented by Joseph Bijur, Robert Shaal, F. E. Booss, F. L. Merrill, Chicago manager, and R. H. Craft.

Sam J. Gorman & Company, Chicago, Ill., attracted constant attention with a number of vibratory specialties.

The Guarantee Electric Company, Chicago, Ill., conducted a demonstration of the assembling of an armature and the adjustment of repair parts. Represented by C. E. Gregory, president.

The Haller Machine Company, Chicago, Ill., exhibited a very complete line of made-up signs, sectional letters, emblems and border effects. These signs were equipped entirely with Fostoria lamps, and many startling, flashing effects were created with the flashers of the Reynolds Dull Flasher Company, which made a joint exhibit at this booth. Represented by E. R. Dull, Charles D. Snow, H. G. Feltzer and William Goltz.

Felix Hamburger, New York, N. Y., made an exhibit of the Siemens flame arc.

A number of these arc lamps were suspended from the girders and two were used under the canopy at the entrance to the building.

Holcombe & Company, Chicago, Ill., displayed a line of gas-electric fixtures.

The India Rubber and Gutta Percha Insulating Company, New York, N. Y., displayed a number of panels and showcases exhibiting "Habirshaw" wires and cables. Represented by James B. Olson, manager of sales, and F. M. Dusenberry.

The Krantz Manufacturing Company, Brooklyn, N. Y., exhibited a line of special switchboard and panelboards, introducing several new features in panelboard construction. Represented by Fred R. Jenkins, western agent.

The J. Lang Electric Company, Chicago, Ill., exhibited a line of switches, switchboards, panelboards, connectors and electrical specialties. A feature of this exhibit was a number of photographs of installations carried out by this company. Represented by Warren Ripple, R. S. Ripple and E. H. Hawkins.

The Lincoln Electric Manufacturing Company, Cleveland, O., exhibited a line

SOME EXHIBITS AT THE ELECTRICAL SHOW, COLISEUM, CHICAGO, ILL., JANUARY 15–27, 1906.

of variable-speed motors and electrical machinery.

The Manhattan Electrical Supply Company, New York, N. Y., showed some interesting electrical supplies. A feature of this exhibit was the "Sarco" flaming arc lamp. The "Sarco" specialties were very much in evidence, the green card of the "Sarco" pendant switch appearing in almost every booth, and the "Sarco" material being displayed by all of the supply companies.

The Mark Manufacturing Company, Chicago, Ill., exhibited a large number of sizes of "Navalite" enameled conduit. Represented by D. L. Markle, conduit business manager, and C. E. Van Court.

The McRoy Clay Works, Chicago, Ill., showed several specimens of crude material and finished conduit.

The McFell Electric Company, Chicago, Ill., made a joint exhibit with J. Allen Haines, Chicago manager of the Electric Gas Lighting Company, of Boston, Mass.; Bishop Gutta Percha Company, New York, N. Y.; Dayton Electrical Manufacturing Company, Dayton, Ohio; American Electric Heater Company, Detroit, Mich., and Schwarze Electric Company, Adrian, Mich.

The Metropolitan Electrical Supply Company, Chicago, Ill., showed a general line of supplies, the "Hylo" turn-down lamps and "Skeedoodle" attracting much attention. The new "Skeedoodle J" was introduced and this very simple device created considerable interest. The new Barriett motor was also shown, as well as a line of dry batteries. Represented by W. J. Henderson, secretary.

The Miller Anchor Company, Norwalk, Ohio, exhibited various sizes of the Miller anchor and boring tool. A feature of this exhibit was a boring tool equipped with a ratchet brace and "universal" coupling for horizontal boring. Represented by G. H. Miller and F. B. Miller.

The Monarch Electric and Wire Company, Chicago, Ill., carried an attractive line of electrical supplies and was represented by a corps of salesmen from the local office.

The National Carbon Company, Cleveland, Ohio, exhibited a fine line of carbon products, battery carbons, carbon brushes, electrodes, arc lamp pencils, battery and other carbons. Represented by N. C. Cotabish, Wallace O'Connor and A. V. Ward.

The Niagara Tachometer and Instrument Company, Buffalo, N. Y., exhibited several forms of fluid tachometers and speed gauges.

The Nungesser Electric Battery Company, Chicago, Ill., displayed a line of dry batteries. Represented by H. S. Greene.

The Osburn Flexible Conduit Company, New York, N. Y., and the National Metal Molding Company, Economy, Pa., made a joint exhibit. This booth was constructed entirely of various sizes of "Economy" iron conduit, the roof was constructed of about 4,000 feet of unbroken, interlaced "Flexduct" flexible conduit. The "House of Economy and Flexduct" was designed by I. A. Bennett, western sales manager, and the company was further represented by C. E. Corrigan, vice-president and general manager, and S. A. Rall.

The Overbagh & Ayres Manufacturing Company, Chicago, Ill., exhibited a line of special shades and reflectors.

The H. T. Paiste Company, Philadelphia, Pa., exhibited an attractive line of sockets, switches, rosettes, panel cutouts, panelettes, entrance switches, attachment plugs, arc light cutouts and taplets. Represented by H. T. Paiste, James Wolff and George McElwee, better known to the trade as "Aleck."

The Peru Electric Manufacturing Company, Peru, Ind., made a most artistic display of National Electric Code Standard specialties. The exhibit included a series of side panels showing a full line of cutouts, fuse blocks, fuse cutouts, rosettes, weatherproof sockets, attachment plugs, sign receptacles, tie buttons and a bull's-eye made up of standard porcelain insulators. Represented by A. H. Kling and E. L. Ogle.

The H. A. Petersen Manufacturing Company, Chicago, Ill., was located in an artistic booth constructed of electrical conduits and fittings. Represented by H. A. Petersen.

The Phœnix Glass Company, New York, N. Y., exhibited a fine line of electrical glassware, showing various forms of inner globes, leaded glass shades and frosted and decorated globes and cut-glass effects. This exhibit was the centre of attraction for those artistically inclined, the possibilities of electrical decoration being remarkably well shown. Represented by A. H. Patterson, E. H. Fox, western manager, and C. C. Fricke.

Porter & Berg, Chicago, Ill., exhibited a line of supplies, including Locke high-tension insulators, 50,000, 60,000 and 75,000 volts; Miller anchors, Wilson trolley catchers, Kalamazoo wheels and lamps, Speer carbon brushes, Crouse-Hinds Company headlights for interurban cars, International registers, name-plates and badges, Colonial incandescent lamps, a standard line of strain insulators and insulating material. The "Empire" safety tread for car steps and entrances was also shown. Represented by E. R. Mason.

The Reynolds Electric Flasher Manufacturing Company, Chicago, Ill., made a very attractive exhibit of "Reco" flashers. The Reynolds "Twirler" was also on exhibition, and this was the centre of a good deal of interest. A number of the flashed signs about the hall were operated by the Reynolds flasher. Represented by C. F. Zeigler.

The John A. Roebling's Sons Company, Trenton, N. J., exhibited electrical wire and cables and the new Roebling soldered rail-bond.

Roth Brothers & Company, Chicago, Ill., exhibited a line of small motors driving grinders, dental engines and small air compressors.

The Safety Armorite Conduit Company, Chicago, Ill., showed a line of "Loricated" and galvanized conduit in different sizes. A feature of this exhibit was a stack of conduit with an incandescent lamp at one end of each pipe showing the smoothness of the bore. Represented by M. B. Austin & Company, Chicago agents.

W. Schiedel & Company, Chicago, Ill., made an attractive display of X-ray tubes, radiographs and special high-frequency apparatus.

W. H. Schott fashioned the entrance of his booth after the design of a triumphal arch. In this booth there was exhibited the well-known Schott system of heating for central stations. Represented by M. O. Payne.

J. L. Schureman & Company, Chicago, Ill., exhibited a line of automatic motor-controlling devices, elevator starters and distant control switches.

The Simplex Electric Heating Company, Boston, Mass., exhibited a complete line of heating and cooking utensils, showing flat-irons ranging from the special three-pound iron for travelers to fifty-pound tailors irons. Represented by H. R. Hixon, Edward Strauss and A. W. Doe.

The Standard Electrical Manufacturing Company, Niles, Ohio, and the Star Electric Company made a joint exhibit of incandescent lamps, dry batteries, revolving fans and decorative lamps. Represented by J. P. Gilbert, H. H. Albert and T. H. Bullock.

The Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass., exhibited a Challenge Gordon press driven by an L-type direct-current motor. There was also a display of standard induction motors, arc lamps, including the new K type arc lamp, with rod construction and special features of insulation, transformers, arc light regulators, circuit-breakers, Wright demand indicators, measuring instruments, direct-current switchboard material, series arc panel, with new form bayonet fused switch. A series of views at the Pittsfield works of the company was shown with the Green automatic stereopticon. Represented by A. A. Morton, A. Perry and C. A. Mann.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., exhibited a section of the switchboard built for the Kinloch Long-Distance Telephone Company, of St. Louis, Mo. The total capacity of this board is 12,500 multiple lines, with jacks on five-sixteenth-inch centres. There was also a full line of farmers boards, common battery and magneto systems, the new No. 7 transmitter, intercommunicating systems, railway and mining telephones and telephone cables. Represented by J. P. Cracraft, E. B. Shafer, A. B. Smith, J. J. Nate, P. D. Myers, C. E. Lewis, C. W. Schafer, A. O. Stigberg, E. R. Reinke and H. J. Wilms.

The B. F. Sturtevant Company, Boston, Mass., exhibited a complete lighting and power plant and auxiliary machinery.

The Swedish-American Telephone Company, Chicago, Ill., exhibited a complete line of telephone equipment, wall and desk sets and switchboards. A feature of this exhibit was the illuminated picture of the large new factory the company has re-

cently completed. Represented by A. V. Overshiner and J. A. Russell.

J. F. Taylor, the official photographer, was kept busy making photographs of the exhibits. His booth was decorated with large photographs of power plants and installations.

The Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., made a joint exhibit with the Nernst Lamp Company and the Cooper Hewitt Electric Company. The Westinghouse Electric and Manufacturing Company had on exhibition the new graphic recording voltmeter and also a complete line of switchboard and portable measuring instruments. There was also exhibited a line of circuit-breakers, transformers, particular attention being given to the Westinghouse five-kilowatt pipe-thawing transformer. The motor exhibit included several sizes of direct and alternating-current machines and also fan motors of various types for both direct and alternating current. Mounted upon large display boards was a complete line of overhead railway line material for direct-current and single-phase alternating-current catenary construction. There was a complete line of arc and incandescent lamps. The large sign was illuminated with Sawyer-Man incandescent lamps and one side of the exhibit was lighted by Cooper Hewitt mercury-vapor lamps, the other side being lighted by Nernst lamps. The following representatives were present: Westinghouse Electric and Manufacturing Company—T. P. Gaylord, manager of Chicago office; W. R. Pinckard, Malcolm MacNeil, J. W. Busch, Malcolm Carrington, C. A. Ross, Roy Schaulin, Charles Talbot, A. L. Millard, R. H. Moore, A. M. Miller, W. D. McDonald, C. W. Regester, Stephen Gardiner, E. M. Buschoff, Norman Stewart, H. H. Caughlan, S. G. Peticolas, R. L. Radcliff, S. J. Moran, J. P. Gardiner, Ivar Henning, W. M. Oleen, B. J. Brown and George W. Canney. Westinghouse Machine Company—J. B. Allen, western manager; Messrs. Wilkinson, Hinn, Simmons, Rosie, Johnson and Tripp. Nernst Lamp Company—Max Harris, general sales manager; A. C. Wales, district sales manager; Messrs. Griffith, Keene and Miller, Chicago, and G. C. Keech, of the Cooper Hewitt Electric Company. J. C. McQuiston, superintendent of the Westinghouse Companies Publishing Department, and J. W. Lewis were also in attendance.

AN EXHIBIT AT THE ELECTRICAL SHOW, COLISEUM, CHICAGO, ILL., JANUARY 15-27, 1906.

The Universal Electric Storage Battery Company, Chicago, Ill., exhibited a new type battery for portable and central station work. This battery makes use of a new style of assembled grid, using a trough section for carrying the active material and separating these sections by strips of cellulose and perforated wood. Represented by A. N. Bentley.

The Vesta Accumulator Company, Chicago, Ill., exhibited a line of storage batteries.

The Wagner Electric Manufacturing Company, St. Louis, Mo., exhibited a single-phase elevator motor with controller, transformers, a combined voltmeter and ammeter for lamp testing, a variable-speed, three-phase, five-horse-power motor, a Ewin & Company house pump driven by a Wagner induction motor. Represented by Thomas W. Combiths, C. E. Richardson and C. C. Warner.

The Western Electric Company, Chicago, Ill., exhibited an extensive line of apparatus. This included a vertical type, marine lighting set of fifty kilowatts capacity, a complete line of power motors and series-wound, box-type crane motors. Upon an angle iron frame were mounted a twelve-inch, sixteen-inch, twenty-four-inch and a thirty-inch exhaust fan. A series arc panel and arc light regulator, with its transformers, controlled the current for the alternating arcs, the transformer stepping the current up to 2,200 volts from the 220-volt house service. On two standards, one in each corner of the booth, were shown six multiple alternating-current and six direct-current arc lamps. One of the latter is designated as an "indestructible" lamp, the carbons being short-circuited and the resistance heated white hot without apparent injury to the lamp. Other features were a sewing machine motor, electric soldering irons, Gladstone batteries, D & W fuses, emery grinder, driven by a special motor made with extra heavy shaft and bearings, and a representative line of ceiling and desk fans. The background was formed in large part by three handsome oil paintings showing the new Hawthorne plant, covering over 600 acres and housing 2,300 employés, the Chicago city plant and the New York factory. Mr. A. L. Tucker and a corps of representatives were constantly in attendance.

Thomas G. Grier, Chicago, Ill., had an exhibit as western representative of the Chase-Shawmut Company, Harvey Hubbell, Imperial Porcelain Works, Knapp Electric and Novelty Company, McLeod Ward Company, Wirt Electric Company, Electric Manufacturing and Equipment Company, Nungesser Electric Battery Company and American Circular Loom Company.

The Rock Island Battery Company, Cincinnati, Ohio, made a fine display despite the fact that on the night of January 11 its factory was completely burned out. The company was represented by M. A. Loeb, general manager; Sidney Loeb, and W. B. Roberts.

George W. Conover & Company, Chicago, Ill., exhibited the "Equipoise" telephone bracket. Represented by George W. Conover and H. Durant.

The American Electrical Salesmen's Association.

The first regular meeting of the American Electrical Salesmen's Association was held at the Grand Pacific Hotel, Chicago, Ill., January 20. The following programme was announced:

9 A. M.—Meeting called to order; Vincent Gray, president. Minutes of previous meeting. Secretary's report. Report of electrical engineers and some suggestions; E. E. Rines, chairman. New business. Two questions: Shall this association publish an official paper of its own? What shall be done toward maintaining permanent headquarters for association?

12 O'CLOCK—Adjournment for lunch.

1.30 P. M.—"Our Purpose," President Vincent Gray.

1.45 P. M.—Illustrated address, J. Robert Crouse.

2.15 P. M.—"Modern American Meter Practice," R. C. Lanphier.

2.45 P. M.—Five-minute address by a few of the members present on salesmanship.

3.15 P. M.—Selection of next meeting place.

3.30 P. M.—Meeting open for general discussion.

6 P. M.—Adjournment.

6.30 P. M.—Dinner.

8 P. M.—All members were requested to be at the Coliseum at eight o'clock, where the ladies' tea room had been placed at the disposal of the association.

Influence of the Earth in Wireless Telegraphy.

A good deal of interest has been shown recently in the statement that grounding a wireless telegraph station impairs considerably the efficiency of the station. The London *Electrician,* in its issue of December 29, gives an abstract of a recent German paper by Herr J. S. Sachs, detailing the author's experiments to arrive at some definite conclusions in this matter. The work was suggested by Professor Drude, and the system employed was due to the latter. It consisted of a primary circuit containing a spark-gap and a condenser, and a secondary circuit with its ends connected, respectively, to an air wire and a balancing capacity. The primary was a single turn of thick wire interrupted with a spark-gap. Its condenser was made of lead-foil fastened to a glass plate. The secondary was inside the primary, and possessed ten well-insulated wires wound in a single layer on an ebonite ring 8.7 centimetres in diameter. The air wire consisted of a brass tube three metres long and 1.4 centimetres in diameter. The balancing capacity was a metal plate. The coils were designed to resonance, and the wave-length was computed to be thirty-one metres. The receiver differed from the sender only in having a constantan-iron thermo-couple in the position of the sender's spark-gap. The experiments were generally carried out in the open court in front of the Physical Institute of Giessen. The distances between sender and receiver varied from twenty-five to fifty metres. Readings were taken by means of galvanometers placed inside the institute building, to which wires were run from the thermo-couple. In order to make allowance for the variableness of the energy radiated from the sender a coil called a standard coil, not in resonance with the sender, was kept in a fixed position relative to the sender's winding and was provided with a thermo-junction similar to that in the receiver. This junction was also connected to a galvanometer.

The mode of experimenting was to pass a current through the induction coil for the same period in each observation of a set. The deflections of the galvanometers connected with the two thermo-couples, divided the one by the other, gave the figures which were used in drawing conclusions.

In this manner were investigated the effect of varying the relative positions of the various parts of the sending apparatus or receiving apparatus, and the effect of symmetry of the two ends. Another series of experiments was performed to contrast the behavior of the receiver when sender and receiver were wholly insulated, with its behavior when the balancing-plates at both ends of the thirty-metre stretch were connected to a plate buried one metre in the ground. When insulated the balancing-plates were one metre above the ground. It was found that the readings of the galvanometer were about twice as great when the whole apparatus was insulated as when the apparatus was earthed.

In order to examine the influence of the earth on the propagation of waves the author used the principle that this influence must alter with alteration of the height of the apparatus above the ground. In dry, frosty weather, with air wires vertical and balancing-plates horizontal, the maximum efficiency occurred when the apparatus was three metres above the ground. The effect at this height was more than four times the effect when the plates were only ten centimetres above the ground. On the other hand, in wet, cloudy weather, the maximum occurred at about one metre elevation, the effect at this height being about two and one-half times the effect at the height of ten centimetres. In both cases the maximum value was maintained, with slight change, on further raising the apparatus to four or five times above the ground.

Experiments conducted to show the effect of distance on transmission gave values obeying the inverse square law. The distances varied between twelve and twenty-four metres.

The author's conclusions are stated thus: the earth's surface is, for waves of thirty-one metres, a strong absorbing and a weak reflecting medium. The connection to earth of sender or receiver is greatly prejudicial to transmission. Insulating it is decidedly favorable. It is desirable to install the apparatus as high above the earth as possible. The integral effect at the receiver varies inversely as the square of the distance of transmission.

Electric Cars at the New York Automobile Shows.

While the number of electric automobiles exhibited at the two New York automobile shows was comparatively small, the showing was much better than at any previous exhibition. The commercial electric vehicles, as usual, were well represented, but the pleasure cars were particularly interesting. Advantage is being taken of the ease with which the electrical equipment may be disposed under the car body, and several novel types were shown in which this had been done. The battery equipment of certain cars is divided into two or three sections, disposed at different points so as to distribute the weight. Some of the new electrics, carrying one section of the battery in front, at first sight are taken for gasoline cars.

The exhibition of electric appliances was large, including storage batteries, the new type of Edison cell among others, sparking coils, speed indicators, electric elevators, rectifiers, motor-driven air compressors and electrically welded fittings, etc.

In the new Edison cell the pockets containing the nickel active material have a cylindrical form, to avoid buckling, and the nickel grains are mixed with a "metallic flake" to increase the conductivity. But one of the new nickel plates will be used for each iron plate. In the old type of cell there were two.

In conjunction with the Automobile Show in the Sixty-ninth Regiment Armory the Aero Club of America exhibited a large number of balloons, aeroplanes, kites and other apparatus of a similar nature.

Buenos Aires Electric Tramways.

By Dr. Alfred Gradenwitz.

THE city of Buenos Aires, which has been making a rapid development ever since its severing from the Spanish mother-country, has a population of upward of 800,000 inhabitants.

The most extensive of the seven tramway systems of this city is the Anglo-Argentine Tramway Company, the lines of which cover an aggregate length of about sixty-five miles. An electrification of this network having become desirable, owing to the ever-increasing traffic and to the necessity of continuing the lines into the suburbs, the Allgemeine Elektricitäts-Gesellschaft, of Berlin, was entrusted with the installation. Though the city possesses two large electrical power stations, a new station was constructed for the purpose of feeding the system.

The use of high-tension, three-phase currents was found most desirable, owing to the large extension of the tramway system, including extreme distances of as much as eight and three-quarters miles, this current being converted in several substations into direct current at the working pressure of 550 volts.

Owing to the size of the power station and because of the hot climate it was not thought suitable to employ cooling towers, for which reason the building was erected in the neighborhood of the Riachuelo river. This situation affords facilities for deriving the feed water from and discharging the exhaust water into the river, while on the other hand the supplying of fuel was made inexpensive. A disadvantage of the situation chosen for the power station was that satisfactory building ground was found only at several yards depth beneath the street level; an artificial foundation was therefore necessary.

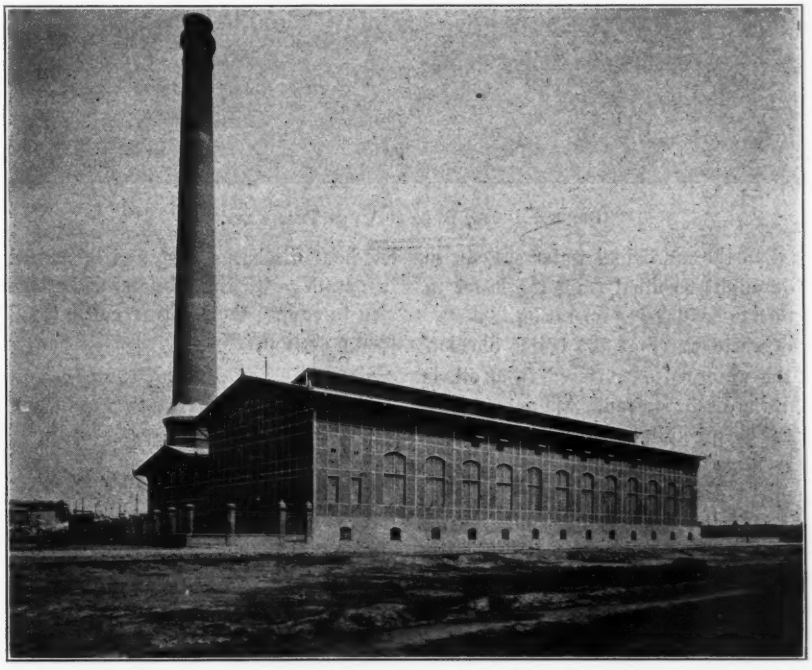
After completing the sheet piling for the outer walls the mud between the walls was dredged away down to the solid ground, after which the sheet piling was cross-braced and as much water as possible was pumped out and fine sand was introduced to a thickness of two yards. After this sand layer had been allowed to set a concrete layer (one part of Portland cement, two parts of sand and six parts of coarse gravel) was introduced to a thickness of one yard and the masonry of the outer walls was carried above the level of the ground. After the concrete of the outer walls had hardened the inner space of the building ground was dredged away, and as soon as the mud was removed from the pit a layer of sand and afterward a concrete sole were introduced and the masonry of the boiler and engine foundations was erected. In order to avoid any breakage of the concrete sole in the case of excessive water pressure this was reenforced by means of old tramway rails spaced 1.5 feet, which greatly increased the bearing capacity of the concrete in addition to ensuring a uniform distribution of the pressure.

POWER-HOUSE.

The engine and boiler house, which is about 230 feet in length and about 130 feet in breadth, was built of iron construction with masonry walls, the pedestals of the iron construction being fitted into the foundations. The roof was covered with corrugated galvanized iron. An aggregate amount of about 350 tons of structural iron and 29,000 square feet of corrugated roofing were used. The masonry walls were built with cement mortar, the outer face being pointed with colored mortar and the inner surfaces floated and set. The walls of the engine and boiler houses are covered inside with an oil paint to a height of 6 feet, the upper surface of the walls is covered with a colored sizing. The wooden sheathing of the roof is also oil painted.

The chimney is 220 feet high and 9.3 feet in clear width at the top. It is made of perforated radial tiles and stands on a concrete foundation 22 feet thick. Both the chimney and station building are supplied with effective lightning rods.

The boiler house contains sixteen water-tube boilers for 150 pounds steam pressure, each having 2,400 square feet of heating surface in contact with the water. Each is provided with a steam drain and a superheater, and is capable of generating normally 8,000 pounds, and, when forced, 11,000 pounds of steam. An electrically driven economizer for heating the feed-water has been fitted into the smoke flue.

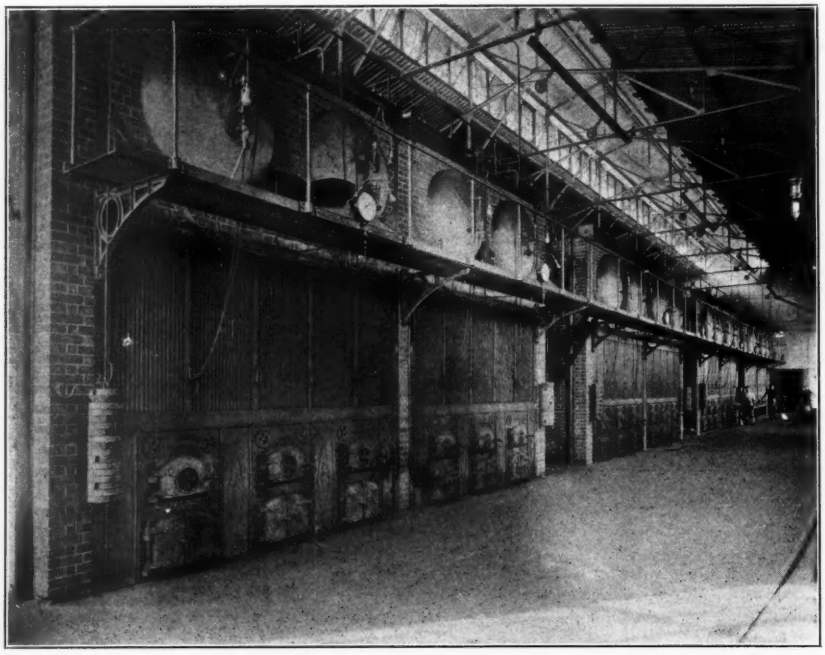


POWER STATION, BUENOS AIRES TRAMWAY SYSTEM.

A coal-handling tramway and weighing system convey the coal immediately to the front of the boilers, taking the coal from the sheds in the storage yard. The feed-water is drawn from and the exhaust water discharged into the river by a canal, the water passing through several sieves placed one behind the other, after which it flows on into a settling tank where any remaining solid matter is deposited. From the clearing tank the water flows through an automatic water-softener into the feed-water tank, from which it is drawn by three horizontal direct-acting, quadruple, compound, duplex steam pumps, delivering 15,800 gallons per minute each. The

pumps serve also, in case of necessity, to operate the Pelton wheels, which will be referred to below.

The feed-water tank has been connected as well to the municipal water system, so that it might be filled from the latter in case of non-condensing operation.



Boiler House, Buenos Aires Tramways.

The waste water of the boiler blow-off and the water-softener, freed from oil, is led into a discharge tank, where any solid matter is precipitated and whence the water flows into the Riachuelo river through a discharge pipe. All the condensing water containing oil passes through a coke filter before entering the discharge pipe so as to reach the river in a condition entirely free from oil. The steam pipes leading from the boilers to the engine room have been arranged on the loop system so as to enable any repairs to be carried out without discontinuing the service.

An ash elevator capable of lifting 22,000 pounds has been provided to remove the ashes.

The engine house contains four horizontal compound steam engines, with individual jet condensers having a normal output of 1,200 and a maximum output of 1,650 effective horse-power each. Each engine is coupled to a three-phase generator rated at 1,000 kilowatts, 6,600 volts and twenty-five cycles. Excitation is provided by three induction motors, each direct coupled to an eighty-kilowatt direct-current dynamo.

Two Pelton wheels have further been provided as a reserve to drive the exciter sets in case of emergency.

The storage battery of sixty-five cells has a capacity of 330 ampere-hours at a one-hour discharge rate, and is connected in parallel with the exciters, while having also to supply the lighting current to the power station.

A small motor has been connected to each engine to assist in paralleling the machines and for throwing the load off and on.

The switchboard at the power station consists of twelve marble panels, the panels carrying the low-tension apparatus being installed on an elevated scaffold, while the panels on which the high-tension apparatus has been mounted are installed in a room below. The engine house is provided with a traveling crane of thirty-tons capacity for handling the heavy machine parts.

The three-phase currents at 6,000 volts generated in the power station are led to three substations by means of underground cables, each being connected by a cable to the power station. Arrangements have been provided in the substations to enable the connections of the various cables to be changed. The high-tension current is converted in the substations into direct current at 550 volts.

SUBSTATIONS.

Each substation contains three rotary converters rated at 400 kilowatts, 550 volts each, nine single-phase transformers transforming from 6,600 volts to 230-460 volts, one starting set consisting of a three-phase motor and direct-current dynamo, a switchboard with the necessary regulating and measuring apparatus and switching apparatus for the high-tension cables.

The transformers are cooled by means of electrically driven centrifugal fans with an output of 3,600 cubic feet each per minute. The power station is connected to the three substations by means of 7,000-volt, iron-armored, three-con-

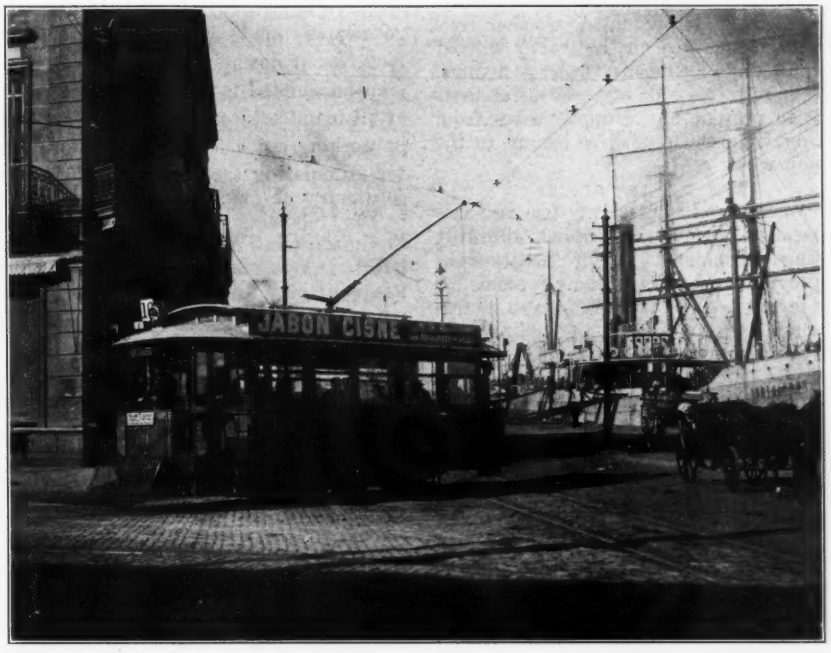
A Typical Street, Buenos Aires Tramway System.

ductor cables with test wire. The cross-section of each core is 60,000 circular mils. The copper strands of these cables are surrounded each with impregnated yarn and paper insulation, over which is another layer of yarn and paper insulation and then a lead sleeve, followed by a double iron band arrow covered with compound. The insulation resistance of the cables is, as a minimum, 1,000 megohms, with sixty seconds charge and 100 volts measuring tension. From the substations the direct current is supplied to the various feeding points through low-tension cables of 200,000 to 1,200,000 circular mils section.

The cables were laid under the sidewalk, while at street crossings cast-iron pipes were laid in ducts through which the cables were passed. The substations are connected by telephone with each other and with the power station.

THE PERMANENT WAY.

The existing railway track having proved too weak for electrical operation, it was decided to lay out new grooved rails of heavy section, a rail 6.75 inches in height being chosen. The weight of this rail is eighty-six pounds per yard, the weight of the track being 192.5 pounds per running yard, and the gauge is four feet eight and a half inches. The track was laid out in such streets as had been laying out the track, as on one hand the operation of horse-driven tramways could not be interfered with, while on the other, especially in the centre of the city, the track of other tramway lines had to be crossed frequently, in fact nearly at each street crossing, thus requiring the installation of temporary tracks.



Motor Car and Trolley Wire System, Buenos Aires Tramways.

Car Sheds, Buenos Aires Tramway System.

paved on longitudinal concrete sleepers, while wooden transverse sleepers were chosen for those streets which still have to be graded.

Considerable difficulties were met in

Both single and double-track lines have been built. The maximum gradient is seven and five-tenths per cent and the minimum radius of curvature forty-two feet.

RETURN CONDUCTORS.

The rails are used as return conductors to the substations, to which end the joints are connected with one another by copper flanges of 1.65 square inches cross-section. In order to ensure an unbroken conducting system the tracks are cross-connected at distances of about 300 feet as well as at the switches by copper cross-bonds of 1.65 square inches cross-section. The rails and the substations were connected with each other by insulated return cables laid in the ducts for the feeding cables wherever this was possible.

THE OVERHEAD WIRE.

The trolley wire which is fed from the substation by underground cables consists of hard-drawn bare copper wire 106,000 circular mils in cross-section, having a conductibility of at least ninety-eight per cent and a minimum breaking strength of 17,000 pounds per square inch.

Wherever the local conditions allowed the trolley wire to be suspended from house walls this means of suspension has been chosen, an effective sound-dampening device being introduced into the span. At the remaining places tube and lattice-work poles, with or without brackets, have been installed, all these poles being set in a foundation of concrete. The contact wire has been suspended eighteen feet above the top of the rails, the insulation being at least a double throughout. Switches have been provided inside of the city every 1,500 feet and outside about 3,000 feet, so as to cut out the current from any part of the trolley wire in the case of fire or

other accident. As a safeguard against atmospheric discharges lightning arresters have been provided, which are connected to the contact wire and to a ground-plate. To protect telegraph and telephone wires against any accidental contact with the trolley wire, impregnated wooden rods have been mounted on the trolley wire at any crossings by means of brass fittings. These protective rods carry hooks at their ends to prevent any dropped wires from sliding from the protective bar on to the trolley wire.

THE ROLLING STOCK.

Two hundred and seventy-two two-axle motor-cars have been provided, affording seating accommodation for twenty-eight passengers each and standing room for twelve more. The trucks of these motor-cars are formed of two longitudinal girders, reenforced by transverse iron girders, all parts being safely riveted to each other. Both the axles and rims of the wheels are made of Siemens-Martens steel. Plate and spiral springs have been provided to ensure an efficient support of the car body.

The trucks are equipped with a four-block jaw brake, operated from either platform. The car body is 16 feet long and 7.5 feet wide. The wheel-base is 5½ feet.

The electrical equipment of each motor-car consists of two motors rated at twenty-five horse-power each, two controllers for series parallel operation and electric braking, resistances, lightning arresters, etc. Eighty of the old horse-cars have been converted into trailers.

The rolling stock is completed by a motor-car designed as a test car, to enable any measurements to be carried out on the rail joints. This is equipped with a direct-current motor of one horse-power, 550 volts and a five-volt, 200-ampere, direct-current dynamo, which is direct-connected to the motor.

The four car sheds, used before the introduction of the electric service, have been converted to accommodate the present rolling stock. Owing to the hot climate the car sheds have been left open both in front and at the back. Each of the sheds as well as the Caseros repair shop have been provided with hand-operated transfer tables.

The Wausau (Wis.) Municipal Plant.

The municipal electric lighting plant of Wausau, Wis., has shown some very interesting results for the year's operation ending December 14, 1905. The report of the board of public works of Wausau shows that the total cost of the plant was $12,062.66. The cost of maintenance and repairs was $190.80. The cost of electric current was $3,224.19. The salary of the electrician was $600. The total number of hours the lamps burned was 3,293. The board figured four per cent interest on the investment and four per cent for depreciation of the plant and charged this up to operation. The cost of current per lamp was $30.86. It is estimated that the saving to the city during the past year was $767.49. Mr. Jacob Cloos was consulting engineer on the plant.

Cooperation in Increasing the Demand for Electrical Apparatus and Supplies.

At the last convention of the National Electric Light Association a formal suggestion was made by a number of manufacturers of incandescent lamps that some plan be adopted to secure the cooperation of all manufacturers of electrical supplies in working out a broad-gauged campaign for stimulating the demand for current-consuming devices.

The following open letter sets forth the initial plans of the "Cooperative Electrical Development Association," which has been organized to carry out a campaign along these lines of cooperation:

Association and cooperation are increasingly the watchwords of modern commercialism. "Competition is the life of trade" crystallizes the sentiment of a period in business development which is merging into a new régime, characterized by the sentiment "cooperation is the life of trade."

Not cooperation of manufacturers or others to set prices or conditions of sale to the buyer, but broad-gauged cooperation among all the different interests through associations, societies or otherwise, working for general progress and improvement on the basis of the square deal. Through such cooperation furthermore developing the strength to attain an approximation to it.

The governors of the Western states believed the American people should see the wonders of the West before spending their money to visit Europe.

They met and devised cooperative plans for bringing this about.

This was modern cooperation.

The governors of thirteen southern states appreciated that the South needed more people to develop her great natural resources.

They recently met and made plans for cooperating in the expenditure of both time and money to accomplish this result.

This was modern cooperation.

These two instances might be otherwise characterized as associated or cooperative self-interest.

While experience amply proves that self-interest is the great "prime mover" in the affairs of men, the more widely it can be made cooperative or associated (necessitating the recognition of the rights of others) the more nearly it exercises its most proper and efficient function in the line of progress.

May it not be well to consider whether there does not exist likewise in this great electrical field a common ground on the basis of which cooperation of this kind, in some degree at least, may be broadly undertaken to the advantage of all?

At first blush it may seem that our interests are too diversified and conflicting as manufacturers, publishers, jobbers, dealers, contractors, societies, associations, salesmen, central stations, etc., but when we have reviewed all the interests, conflicting or harmonious, the fact remains that they form a continuous chain (kinks and all) from the manufacturer to the consumer.

This great body of 86,000,000 consumers, spending $12,000,000,000 annually, or putting it into the bank for future expenditure, controls the exchequer from which we are all, directly or indirectly, endeavoring to secure an honest livelihood in turn for the making, selling, installing or distributing of electrical apparatus, supplies and current.

If this be true it suggests that there does exist a community of interest among us all for the promotion of the increased use of electrical appliances and devices by the public for light, heat and power, as against all competitive means and methods for the same purposes.

Any increased success in accomplishing this through cooperation obviously predicates greater demand for "everything electrical," from the coal pile to the final appliances through which the public is electrically served.

The question then is—can any scheme of practical cooperation be devised which will bring about the result desired by all, and will such results probably be large enough to justify the expenditure of both time and money in their accomplishments?

This is the subject which has interested the incandescent lamp manufacturers for a year past.

We believe such cooperation is not only possible, but profitably so.

As "faith without works" is profitless, these manufacturers have backed their faith with an appropriation of $10,000, to which has been added another $10,000 from other sources, for the initiation of the plans.

It has been determined to undertake practical work along cooperative lines through the medium of the "Cooperative Electrical Development Association."

While this association will look to the manufacturers generally for the revenue with which to prosecute the plans, equal importance is attached to securing the moral cooperation of all other electrical interests, societies and associations.

It would at this time be premature to go into the detailed plans of the new association, until its activities had both aroused and justified sufficient interest in them.

It may be said, however, by way of passing, that they have been fully and freely laid before many men in the various electrical interests, whose counsel and criticism have been sought and secured.

Whatever degree of merit they may now possess is attributable to their hearty cooperation and encouragement.

As initial progress in this work has been possible along these lines in the past, so, for the future, it points for continued and permanent success to systematic cultivation of the same sources of strength.

Your attention is respectfully called to certain campaigns of commercial business-getting literature which either are, or are about to be, issued to all the central lighting stations of the country, in direct line with the purpose of the new association, through the medium of cooperating advertising agencies.

The objects of the new association are one in common with the electrical technical press along all lines looking to increased commercial activity, directly or indirectly, in the sale of current, and it will both seek their cooperation and endeavor in turn to cooperate with them along any practicable lines.

Finally, coincident with the recent and prospective great advances made by the mechanical and electrical engineers in increasing the efficiency of prime movers, the means of transmission, and the final appliances through which the public is served, this new association stands for a vigorous attempt to match, and, if possible, to exceed these accomplishments in the commercial field through a general appeal to the selling ingenuity of the fraternity for effort along cooperative lines.

To you, if sufficiently interested in the detailed plans of the new association, as they have thus far been developed, the writer would be pleased, upon request, to submit the preliminary prospectus for criticism and comment.

In the spirit of "cooperation," and to the sentiment

All together, all the time,
For everything electrical.

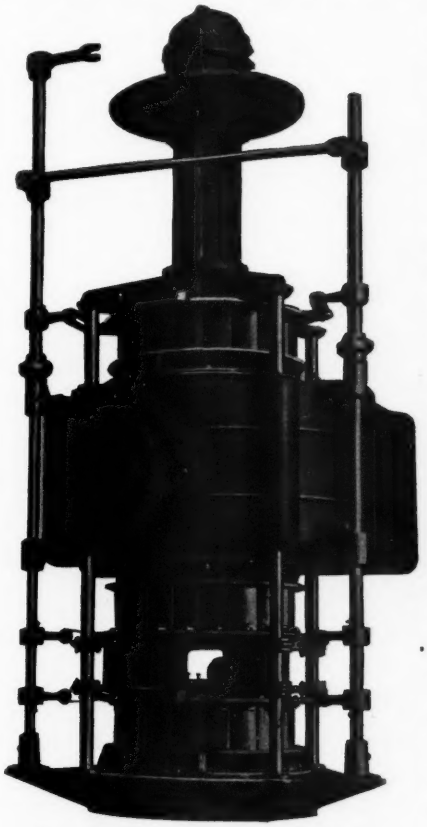
Most respectfully yours,

J. ROBERT CROUSE.

1814 Forty-fifth street, N. E.,
Cleveland, Ohio.

Hydroelectric Installation of the Concord Electric Company, Sewalls Falls, N. H.

An extremely interesting problem in the utilization of a water power with a small fall and large variations of head for the production of electric power has been skilfully solved in the design of two 900-horse-power turbines which the Allis-Chalmers Company, Milwaukee, Wis., has built and is now installing at Sewalls Falls, N. H., for the Concord Electric Company. The first installation will consist of two complete units, each composed of a triplex turbine water-wheel and a direct-connected alternating-current "Bullock" generator, a motor-driven exciter set, turbine governors and electrical synchronizers.



TRIPLEX TURBINE FOR THE CONCORD COMPANY.

As the current is to be used chiefly for lighting purposes, and possibly in connection with other sources of power generation, it is necessary to have the speed of revolutions for the wheels and generators constant, even though the amount of developed power might differ under different heads. Ordinarily, the stream produces a fall which gives a net working head of sixteen feet. In times of flood, however, the water backs up in the lower channel so as to reduce the working head to twelve feet.

To secure the desired results the turbines have been designed each with three sets of runners and gates complete, the three sets being arranged one above the other on a vertical shaft. The three sets of runners are all connected to the tail-race by means of draft tubes, so as to derive the full energy of the water, due to its actual head, from each of the runners, no matter what its relative or actual position may be upon the shaft. The lower runner of each wheel has a draft tube by itself, while a single tube of larger dimensions carries off the discharge water from the two upper runners. The turbines are of the Francis central discharge type. The three runners on each wheel are each of equal size, form and capacity; but they do not all discharge in the same direction. The lower one discharges downward into an individual concrete draft tube. The upper runner discharges downward and the middle one upward, both into a second concrete draft tube which joins the lower one at the bottom of the tail-race. The reactions from the upper two runners practically balance one another, while the reaction from the discharge of the lower runner, being upward, tends to lift a portion of the load on the turbine shaft. This effect is considered negligible in the turbine design, but provision is made for using the pressure due to the head of water actually to carry a considerable part of the weight of the turbines and the generators at all times. This is done by admitting the water of the flume into a space directly under the second runner of each turbine, where it exerts its pressure upward against a circular plate which forms a revolving piston. The water will carry about one-third the weight of the rotating parts. The other two-thirds is carried by a thrust bearing supported by the castings of the turbine.

The bearing is made of generous proportions, so as to operate safely without oil under pressure for lubrication. The lubrication is provided for in an ingenious manner. A well is formed outside the bearing rings and this is filled to a suitable height with oil. The oil flows to the inner part of the bearing through suitable holes, passes through the bearing, guided by proper grooves, and is returned through holes to the well. The circulating action is continuous as long as the wheel is in action and is automatic. At two points below the thrust-bearing the shaft is kept in line by steady bearings carried by portions of the wheel casings. The wheel casings are self-supporting besides carrying the weight of the rotating parts, one section being built on top of the other, and each provided with four stout columns to carry the weight. The casings are steadied and held against vibrations and side strains by having certain parts carried over to the walls of the draft tubes. These walls are of concrete and the draft tubes are also of concrete, the whole—walls and tubes—being built as one solid structure of monolithic character.

RUNNERS OF TRIPLEX TURBINES.

The wheel cases are all divided so as to permit of dismantling without disturbing the shaft or generator parts, and are put together with machined and ground joints.

The shaft itself is in two parts coupled

together just below the generator. The runners are of non-corrosive bronze, each cast in one piece. They are fifty-five inches in diameter. Surrounding each runner are the gates which admit the water to it and control its speed. Outside the gates of each runner and reaching all around it so as to admit water to all parts of the periphery of the wheel at once is a space ample for that purpose.

The gates are composed of movable guide vanes and so constructed that when open they admit a full head of water with but little interference, and when closed totally exclude the water. They are all connected by links to a common gate ring and arranged so that a minimum of power is required to operate them.

The operation is through two countershafts standing parallel to the main shaft. These are each provided with a crank at each set of gates and the cranks are connected to the gate rings by links. One-eighth of a turn of the shaft completely closes the gates. Not more than 12,000 foot-pounds is required for this operation, which is supplied by the governor for each wheel.

The governors are placed on the generator floor beside the generators. They are of the Allis-Chalmers standard type of self-contained oil-pressure hydraulic governor. The design of this governor is such that no changes in arrangement need be made should three or more units be added to the plant. Such additions are not unlikely after two or three years. The permissible variations in speed under sudden variations of load are shown in the following table:

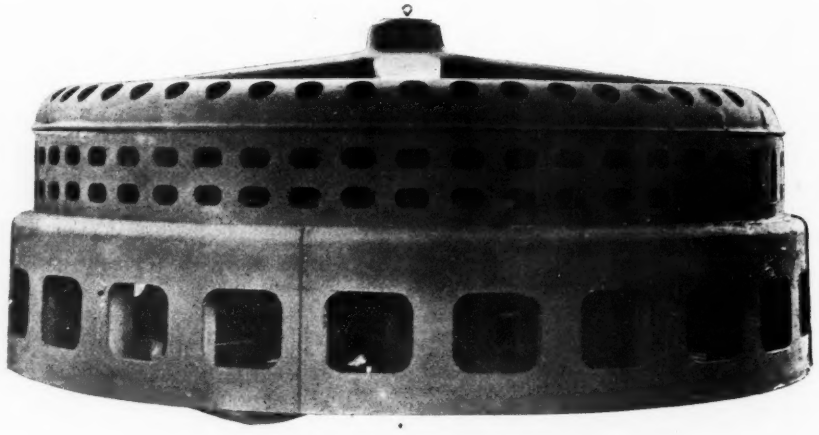
Variation of Load per Cent.			Permissible Variations in Speed.					
25	per cent	.....	Not over 2	per cent	in	1.5	seconds.
50	"	.....	" " 4	"	"	2.0	"
75	"	.....	" " 6	"	"	2 5	"
100	"	.....	" " 8	"	"	3.0	"

Each governor is driven from a horizontal shaft running under the floor, which takes its motion from the main shaft of the turbine through the medium of a bevel gear.

The bevel wheel on the main shaft is formed by attaching a toothed rim to the outside of the collar on the coupling which joins the two portions to the shaft. A "Morse" silent-chain gear connects the governor to the horizontal shaft and drives the governor. The chain is cased in.

The speed is regulated by sensitive fly-balls working against knife-edges and the actual control of the gates is accomplished through the agency of oil, under pressure, operating through the medium of a piston controlled by a pilot valve. These regulators are constructed so as to eliminate "hunting" and ensures very close regulation. The governors are so arranged that they are under control electrically from the switchboard, as synchronizers and motors for controlling the governors form a part of the outfit of the station. This makes it possible to increase or diminish the speed of either of the wheels at pleasure or to shut down units from the switchboard in case of an emergency.

The wheels will each produce 900 horse-power with a sixteen-foot head with a consumption of 620 cubic feet of water per second, or 625 horse-power at a twelve-foot head with a flow of 650 cubic feet per second. Working at full gate, they are expected to develop seventy-eight per cent of the power of the water, or more, and to give eighty per cent return at three-fourths gate. At half gate they are expected to give seventy-five per cent of the power of the water. They operate at 100 revolutions per minute.



VERTICAL TURBINE FOR CONCORD COMPANY, SEWALLS FALLS, N. H.

Standing directly over the turbines with their stator parts supported on the generator-room floor are the two generators, one for each turbine. The rotor shafts are direct-coupled to the shafts of the turbines and form the upper parts of the turbine shafts. The weight of the rotors is carried by the thrust-bearings of the turbines, but they have a steady bearing above the couplings to keep them in line.

The generators are of the Allis-Chalmers "Bullock" vertical water-wheel type, with upper guide bearing supported in a housing bolted to the stator. The stator or armature rests on a substantial cast-iron ring supported by the foundation. The revolving field consists of a cast-steel spider securely keyed to the vertical shaft and provided with dove-tail grooves in its rim for holding the laminated pole-pieces which are secured in place by tapered steel keys. The field-coils are wound with copper strip, bent on edge.

Each generator can deliver 500 kilowatts at 2,600 volts, three-phase, sixty cycles, 111 amperes per line. The speed is 100 revolutions per minute, the revolving fields having seventy-two poles. The fields are wound for separate excitation at 120 volts and the generators have an efficiency of ninety-four per cent at full load, ninety-three per cent at three-quarters load, and ninety-one per cent at half load. They will stand a 100 per cent momentary overload without injury.

The armatures have a three-phase winding of heavily insulated coils capable of standing a 5,000-volt puncture test between coils and frame. The field insulation is tested with 1,500 volts, applied between the coils and field-cores or spider. The supporting yoke for the armature core is of open construction, and since the core itself is provided with numerous ducts or air-channels the ventilation is very thorough.

For exciting the alternators, a motor-generator set, consisting of a seventy-five-horse-power induction motor coupled to a forty-five-kilowatt direct-current generator, is provided. The induction motor is wound for 2,600 volts, three-phase, sixty cycles, and the generator for 120 volts; the full-load speed is approximately 680 revolutions per minute. Both machines are mounted on a common bed-plate and the set has three bearings, two of which are carried in end housings bolted to the stator yoke of the induction motor.

Water-power privileges and a railway concession are being asked for by A. H. McKay from the Blalock colony, Tamaulipas, Mexico.

The New Plant of the Wire and Telephone Company of America.

The Wire and Telephone Company of America has recently completed what is the beginning of an extensive plant for the manufacture of bare and insulated wire, telephone apparatus and other electrical specialties. The company is the successor to the Electric Wire Works and the Empire Wire Company, both of Rome, N. Y.

In determining upon a location for a plant of the size which the new organization has in mind many considerations had to be looked into and it was determined that no better site could be secured than the present one, with its ideal shipping facilities, receiving the services of several trunk railroads and the Erie canal. A spur from the tracks of the New York Central & Hudson River Railroad gives a distribution area of unusual proportions.

It was in August last that the company took over the works of the Empire Wire Company, the wire mill of which has a capacity of 100,000 pounds of bare wire and 80,000 pounds of insulated wire per week. The works of the Empire Wire Company was located about half a mile from the present site, and as the canal lay between it and the railroad it was decided to remove the machinery and concentrate the work in a large plant adjacent to the plant of the Electric Wire Works. The building and real estate of the Empire Wire Company were therefore not purchased.

The plant of the Electric Wire Works had a capacity in its mill of 20,000 pounds of insulated wire and 100,000 pounds of bare wire per week.

The new factory has a ground area of seventy-five feet by 270 feet, with a two-story section running along the entire front of the building. This building takes over the insulating department of both the Electric Wire Works and the Empire Wire Company, leaving the plant of the Electric Wire Works with several additions for the wire-drawing machinery, the copper storage room, the mufflers, pickling and cleaning tanks, tinning department and machine shop. By taking over the space formerly occupied by the insulating department of the Electric Wire Works and adding new wire-drawing machinery, with at least thirty-five per cent increased space, the capacity of the bare wire mill has been increased to 300,000 pounds per week.

In rearranging the wire-drawing machinery the general plan is to complete two independent units running in series in two straight lines down the entire length of the works. At no point will the product double back or retrace its course. The copper rod, delivered in carload lots, is taken through a chute to a platform scale in the copper storage room; from the scales the rod is lifted by a pneumatic hoist and conveyed by trolley to its proper destination. The capacity of the copper storage house is 500,000 pounds of rods, and with the pneumatic hoist one man can unload a car in two hours. From the copper storage house the rod will progress to the wire-drawing machines and from these in turn to mufflers, pickling and cleaning tanks, the processing, as far as the bare wire is concerned, being completed in this building. The machinery of the Electric Wire Works was driven by a steam engine located, with its boiler plant, in the same building. With the new arrangement there will be two main shafts, each driven by a 150-horse-power induction motor. One of these is a Westinghouse type C and the other is a General Electric form L, each three-phase, sixty cycles, 440 volts. An important addition to the wire mill is the new muffler equipment built by the Rockwell Engineering Company. This has a capacity of one million pounds of copper wire per week, if the mill is run twenty-four hours per day.

PLANT OF THE WIRE AND TELEPHONE COMPANY OF AMERICA, ROME, N. Y.

All bare wire is delivered to a storekeeper and shipped from platforms into cars, while the wire to be insulated is passed across to the new building, going either to the cotton and silk machines or further down the factory to the rubber-covered department. The material for the process of rubber covering, the crushers, rolls and heavy machinery is concentrated in one end of the factory, and arrangements have been completed for convenient shipping points at both ends of the building.

In laying out the winding machinery the plan has been to leave room for additional units of the same character for each process, so that no matter how much the plant may be extended the progress of the manufactured product will be uniform. In the present factory space has been left to increase the magnet wire-wind-

ing department at least twenty-five per cent, and the initial capacity of the rubber-covered department will be 100 per cent greater than the present demand.

All machinery is group driven, there being, in addition to the motors already indicated, one seventy-five-horse-power Westinghouse type C, one fifty-horse-power Westinghouse type CCL, one fifty-horse-power Westinghouse type C, one twenty-five-horse-power General Electric form K, and one twenty-five-horse-power Westinghouse type CCL motors. Arc and incandescent lighting is used in the factory and offices, with Cooper Hewitt lamps in the draughting room. Current for lighting is furnished by two twenty-five-kilowatt Bullock alternators, three-wire system, 220 volts, the power being furnished by the Rome Gas, Electric Light and Power Company.

The general offices of the company are in the new building. These are all arranged with high broad windows, with a northern exposure, giving plenty of light throughout the day. For the accommodation of special tools, important records and storage for diamond dies a two-story brick and steel vault has been built, the lower story being part of the stockroom and the upper story opening into the general offices.

The company manufactures pure copper wire from No. 0000 up to No. 40, cotton and silk-covered magnet wire, rubber-covered wire, switchboard cord and cable, German silver wire, piano wire and belt lacing wire. In addition to this it will take up the manufacture of a special form of binding-post, possessing radically new features and for which the company anticipates a wide use. A large part of the present new factory will be devoted to the development of a special form of telephone instrument, several features of which are decidedly novel and attractive. A department has also been created to develop intercommunicating telephone systems on extremely broad lines. This department, under the direction of Mr. F. M. Potter, will analyze the needs of large corporations, and the company will install complete intercommunicating systems, designing and manufacturing the equipment, and keeping the entire responsibility for the whole installation centralized.

The dominant feature of the whole scheme of development of the Wire and Telephone Company of America is "organization." In acquiring its real estate the company has allowed for doubling the capacity of its wire mill and increasing the depth of its winding factory and telephone shops to 600 feet. Rights of way have also been secured to build railroad tracks at distances of 300 feet and 600 feet in the rear of its present buildings. The credit and cost accounting systems have been systematically laid out, and in its welfare work the company has won the loyalty and personal interest of every employé.

In the process of manufacture the company adopts the most stringent measures to ensure a first-class product. Copper rod less than ninety-eight per cent conductivity is rejected, and only experts in each department of the works are employed. In the wire-drawing mill the most modern machinery has been installed, working under the supervision of experts. In every department repeated superficial and specific tests keep both employé and product up to a high standard. In the rubber-covered department this is especially the case, where the company has secured the service of specialists of long experience in the preparation of the rubber compound.

The company is governed by a board of nine directors, five of whom comprise an executive committee upon which the immediate responsibility of management rests. The directors and officers of the company are: J. S. Dyett, president; Oliver Shiras, first vice-president and chairman of executive committee; F. M. Potter, vice-president and chief engineer; S. C. Houghton, Robert A. Downey, Walter C. White, Thomas H. Stryker and S. H. P. Pell.

Amalgamation of Ohio and Indiana Interurban Railway Associations.

It is announced that the Indiana and Ohio Interurban Railway associations are to be consolidated into one organization. Upon the opening of the convention of the Indiana Interurban Railway Association on Thursday afternoon, January 11, a committee of five, with Charles L. Henry, president of the association, as chairman, was appointed to confer with representatives of the Ohio association and make complete the plans for consolidation. The committee of the Ohio association arrived in Indianapolis on Wednesday night and was prepared to confer with the committee of the Indiana organization. Several technical papers were read at the Indiana convention Thursday afternoon and a banquet was held at the Claypool Hotel on Thursday evening.

A bill providing for the adoption of the metric system of weights and measures in all government departments on July 1, 1908, has been introduced into Congress.

American Institute of Electrical Engineers.

The board of directors of the American Institute of Electrical Engineers has received from the Institution of Electrical Engineers, of Great Britain, an invitation to visit England during the latter part of June next. A similar invitation has been received from the Associazione Elettrotecnica Italiana to visit Italy during the industrial exposition at Milan, which opens May 1, 1906. These invitations are in acknowledgment of the courtesies extended by the Institute to the two foreign societies during their visit to this country in September, 1904.

Both the proposed tours will embrace visits to important electrical plants and educational centres, as well as to the points of scenic interest. The trip to Italy would probably be made during the month of May, and the short time intervening makes it impossible to secure special arrangements for transportation in advance. It would, therefore, probably be necessary to depend upon individual arrangements for the transatlantic trip, so that the cost should be estimated by the individual in accordance with his preferences for steamship lines, return trip, etc.

The proposed tour, if made, will not take the place of the regular annual convention of the Institute, which will be held in a city of the Central West from June 26 to 29.

The board of directors desires to obtain, at the earliest possible moment, an expression of opinion from the members of the Institute as to whether they desire to participate in one or both of the proposed visits. Postal-cards are being sent out, and these should be returned at once, in order that an early decision may be reached.

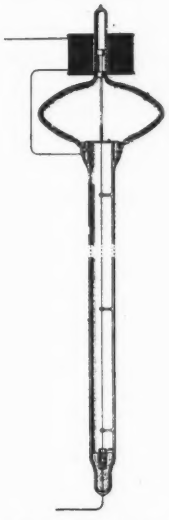
Yates Telephone Association.

At the annual meeting of the Yates County (N. Y.) Independent Telephone Association, composed of representatives of local independent companies, held at Penn Yan, N. Y., January 11, the following officers were chosen for the year: president, Charles E. Guile, Barrington; vice-president, Frank E. Spencer, Benton; secretary and treasurer, Marvin L. Spooner, Milo.

In the hope of overcoming many of the difficulties which have caused trouble between the rural lines and the central office at Penn Yan, a committee was appointed to formulate rules, as follows: Thomas N. Davis, Benton; M. L. Spooner, Milo; Frank E. Spencer, Benton; Benjamin L. Hart, Jerusalem; Charles E. Guile, Barrington.

Electrical Patents.

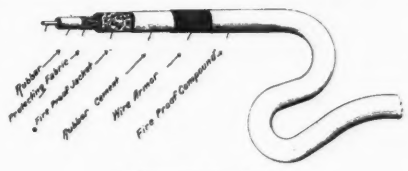
An improvement in vapor-electric apparatus has been invented by Alexander M. Jackson, of Schenectady, N. Y., and he has assigned it to the General Electric Company (808,753, January 2). The present invention relates to improvements in vapor-electric devices, such as mercury-vapor lamps, rectifiers or the like. In devices of the character mentioned it is a common practice to make use of anodes not only of mercury but also of graphite, iron or similar non-vaporizable material. During normal operations these non-vaporizable anodes frequently run at a red heat and thus are subject to slow disintegration. It has been found that this difficulty may be overcome and certain additional advantages secured by sur-



Vapor-Electric Apparatus.

rounding the anode or anodes with a body of mercury. This mercury prevents an undue rise in temperature of the anode without interfering with the attainment of the advantages characteristic of anodes of non-vaporizable material. The invention consists in the combination of a container, a cathode of fluid material, an anode of solid material, a starting device consisting of a conductor adapted to connect said electrodes electrically and to break connection therewith dissimultaneously and fluid material surrounding a portion of the solid electrode.

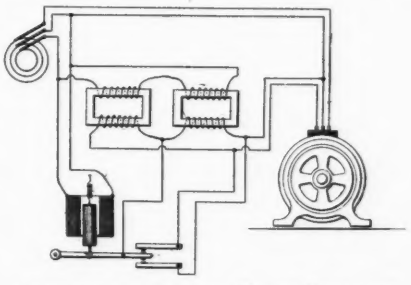
Amanda M. Lougee, of Boston, Mass., has obtained letters-patent of the United States (809,311, January 9, 1906) for an improved fireproof wire. This invention is manufactured as a single article to take the place of the hitherto usually separated insulated electric wire and conduit, and has for its objects the provision of great durability, flexibility, simplicity and cheapness of manufacture, high insulating and fireproof and preferably waterproof character, besides other objects or advantages, such as being unrestricted as to length in manufacture. It consists of a permanently flexible armored electric conductor of indeterminate length having an external size adapted to the usual requirements of office buildings, and



Fireproof Wire.

having its component parts held integrally and permanently together by adhesion, said parts including a wire, an asbestos jacket for the wire rendered moisture-proof by an enveloping coating of cement, enclosed by a tightly woven jacket of wire embedded on both sides in waterproof and fireproof insulation.

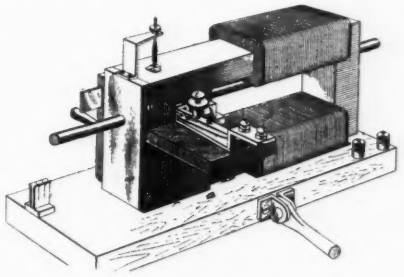
Edwin H. Porter and Burleigh Currier, Philadelphia, Pa., have obtained a patent (808,944, January 2) for an improved alternating-current motor reverser. The invention relates to alternating-current motors of commercial types and particularly to means for reversing their direction of rotation. The object of the invention is to provide a simple, non-sparking, quick acting means of reversing alternating-current motors and one that reverses the motor instantly when applied and which is without complicated switching mechanism, more particularly one that lends itself readily to operation in connection with a relay from a source of alternating-current energy, making it



Alternating-Current Motor Reverser.

automatic in its action. The invention is particularly useful in the automatic operation of rheostats (either inductive or non-inductive), valves that regulate the supply of steam or water to prime movers, or, in fact, is useful in any form of regulator that embodies in its application a reversing movement. The invention contemplates using motors of the standard types in commercial practice with the circuits connected and the power supplied as in commercial practice, except in the circuit that is to be reversed. In this circuit we supply two alternating electromotive forces or currents of opposing phase relation in series, whose algebraic sum is zero. Then by weakening either one of the electromotive forces or short-circuiting it entirely leaves the other electromotive force in part or fully supplying current in the desired direction.

Richard Varley, of Englewood, N. J., has obtained a patent (808,957, January 2), assigning it to the Autocoil Company, a corporation of New Jersey. This invention relates to circuit-controllers and has special reference to that type of circuit-controller used in connection with internal-combustion engines to periodically close the primary circuit of an induction-coil and thus throw the vibrator into operation to create an induced current in the secondary circuit of the coil for



Circuit Controller.

the purpose of igniting the explosive charge. The primary object of the invention is to provide a circuit-closer for use in the situation mentioned above which will close the circuit and hold it closed for a definite period regardless of the speed of the engine, such period being adjustable to conform to the requirements or mean speed of the engine. In carrying out this feature of the invention a magnetic circuit-closer is used instead of a mechanical circuit-closer. This has the characteristic of attracting and moving a circuit-closing element when it is brought to bear thereon instantaneously, whether its approach within attractive distance of the element is brought about slowly or rapidly, and in conjunction with such a magnetic controller a mechanical circuit-breaker is used which automatically opens the circuit after it has magnetically closed after a predetermined interval or dwell entirely independent of the motion of the engine. A permanent magnet is preferably used to operate the magnetic circuit-controller and in order to maintain the strength of such a magnet constant a "keeper" is provided which is to be thrown across the poles of the magnet whenever the engine is not in use. A feature of the present invention is the combining of such a keeper with the ordinary hand-switch of the primary circuit.

Reviews of Current Engineering and Scientific Literature.

A New Method of Tapping Rubber Trees.

In an interesting article describing the cultivation of rubber on the Kepitigalla estate in Ceylon, Mr. Ivor Etherington refers to the remarkable results which have been obtained by a new system of tapping. In this the usual method of cutting V-shaped grooves in the bark is abandoned and a number of spiral grooves are cut instead. The number of these grooves depends upon the size of the tree. With small trees it is usual to cut two grooves diametrically opposite and at an angle of forty-five degrees. As the tree increases in girth other grooves may be added. The latex running out of the wound follows the groove and is collected by small cups placed upon the ground. As the wound heals it is reopened every other day by taking a thin shaving of bark off the lower edge of the groove. This is done because the upper edge heals more rapidly. The trees are tapped every other day for a period of one month, and are then given one month's rest. The wound heals smoothly, so that the process is continuous. It is said that where tapping by the old method gave one pound of rubber per annum, which was considered a fair yield, now five pounds are obtained from trees of the same size. In 1903, with the V-system of tapping, 248 trees on the plantation gave 240 pounds of rubber. Tapped in 1904 on the spiral system, the same trees gave sixty-five pounds of rubber the first month, and in three months had given 392 pounds of rubber. From January to September, inclusive, 1905, the same trees gave 1,317 pounds of rubber by the spiral tapping. The drain on the tree does not seem to injure it at all.—*Abstracted from the India Rubber World (New York), January.*

Brush Contact Resistance.

An account of some experiments made to determine brush contact resistance is given here by Mr. K. C. Nandi. The experiments were made on the dynamo armature of a balancer set with an output of twenty amperes at 250 volts and 1,200 revolutions per minute. Both the motor and the dynamo were bipolar, compound-wound, direct-current machines with carbon brushes. The armature resistance hot was 0.49 ohm. The armature was taken out and mounted on separate bearings away from its field magnets. It was then belt-driven by a motor and readings were taken to determine the electromotive force generated by the earth's field. This electromotive force varied from 0.02 volt at 600 revolutions, to 0.04 volt at 800 revolutions, 0.06 volt at 1,000 revolutions, and 0.065 volt at 1,200 revolutions. As it at no time exceeded three per cent of the total drop of potential, it was neglected in the readings. Readings were taken by sending currents of different intensity through the armature while it was at rest and running at different speeds. The fall of potential was measured by a suitable voltmeter. These experiments were made with the brush springs altered so as to put different pressures upon the brushes. The brush area of each set of brushes was one-quarter of an inch, and it was found that the average resistance per square inch of surface for a current density of twenty amperes was 0.05 ohm. For a density of fifteen amperes it was 0.125 ohm; for ten amperes, 0.18 ohm, and for five amperes, 0.31 ohm. The results agree with those of Arnold, who employed current densities of from fifty to thirty amperes per square inch, and peripheral speeds from 1,200 to 2,400 feet per minute. Arnold's values lie between 0.023 and 0.04 ohm per square inch of contact resistance, increasing with decreasing current.—*Abstracted from the Electrical Engineer (London), January 5.*

Researches with the Electric Arc.

In this concluding section of a study into the behavior of the electric arc, MM. Stark, Retschinski and Schaposchnikoff give the results of an investigation into the drop of potential at the electrodes of an electric arc under various conditions. The cathodic fall of potential was defined as that drop in potential which takes place at the surface of the cathode. It can be measured by determining the fall of potential between the cathode and a point in the arc a short distance away, and then correcting for the drop in the arc. Under suitable conditions the drop in the arc itself can be made so small as not to necessitate correction. Under other conditions it becomes larger, and allowance must be made. Researches were made with mercury electrodes, the supporting electrode being in one case a platinum wire sealed into a small glass tube and inserted through the lower electrode of the lamp so as to project a short distance above its upper surface. The lamp was of the barometric type, a vacuum being maintained by attachment to a pump. With this arrangement it was found that the cathodic drop in the mercury arc is independent of current intensity and is equal to 5.27 volts within less than two per cent. An exploring electrode of mercury was tried to test whether the platinum wire exerted any effect on the phenomenon, but none was found. The same method of investigation was employed to determine the anodic drop, with the anode both hot and cold. With an anode of cold mercury a constant anodic drop of about seven volts was obtained. When the current changed rapidly the drop was found to be about 6.5 volts. When the anode was heated the fall of potential in the arc was greater than when it was cold, and this increase depended also upon the vapor pressure. It was found also that the anodic fall of potential was less when the anode was of iron and when it was placed in a cathode ray. The authors conclude from their investigation that the fall of potential in the arc itself is greater for an atmosphere of hydrogen than for one of carbon dioxide. With electrodes of copper the difference is greater than with electrodes of carbon. This phenomenon is due to the cooling of the electrodes and of the arc. The cathodic fall in the mercury arc with a mercury cathode is independent of the intensity of the current. The anodic fall depends upon a number of factors. It depends upon the constitution of the anode, is less with a cold than with a hot anode, and is decreased by a cathode ray. These results are held to be in accordance with the conclusions of the ionic theory of the arc.—*Translated and abstracted from L'Éclairage Électrique (Paris), January 6.*

Cambuslang Electricity and Destructor Works.

A brief description is given here by Mr. A. J. Abraham of the electricity and destructor works erected by the Lanark county council, England. The plant was put into service on June 5 last, and the electrical supply started on September 13. The works contain two fifty-five-kilowatt, direct-current generators and two compound-wound balancers, with the necessary switchboard equipment. Current is distributed from the station by triple con-

centric cables insulated with paper and diatrine, and laid solid on the Howard system. These cables feed into distributing cables, which are three-core, paper and diatrine-insulated, lead-sheathed and armored, and laid directly in the ground. No junction boxes are placed underground, but feeder and fuse pillars have been erected at various points. The destructor is of the Meldrum front-feed type. It consists of three cells with a grate area of seventy-five square feet. It operates in conjunction with a Lancashire boiler with 986 square feet of heating surface. The boiler can evaporate 6,000 pounds of water per hour. It works at a pressure of 200 pounds per square inch, which is reduced to 120 pounds for the main engines. As a reserve, there is a coal-fired boiler of the same type. The makers guaranteed the destructor to be free from any objectionable odors or dust, and capable of consuming 3,000 pounds of refuse per hour. It was further guaranteed that the destructor would give one pound of available steam for power purposes per pound of average household refuse. The temperature of the combustion chamber is said to be 1,750 degrees Fahrenheit. After the destructor had been in operation for nearly five months a test was made. An analysis of the gases showed an average percentage of over sixteen of carbon dioxide, indicating practically perfect combustion. The total weight of refuse delivered was seventeen tons, 100 pounds. The test was conducted for five and one-half hours, and a consumption of nearly three tons per hour was secured. At this consumption the actual evaporation of water varied from 1.57 to 1.92 pounds, from and at 212 degrees Fahrenheit, per pound of refuse. The weight of water evaporated per hour was 10,260 pounds. Fifteen per cent of this is employed for forced draught and driving the pumps, leaving the rest free for generating purposes. During the test the generating plant consumed only twenty-five per cent of the steam, and sixty per cent was blown off. During the test 515 kilowatt-hours were generated. Had the generating plant been large enough 1,650 could have been produced. This is at the rate of ninety-seven kilowatt-hours per ton of refuse. Tests of the temperature of the destructor showed that it was not less than 2,500 degrees Fahrenheit.—*Abstracted from the Electrical Review (London), January 5.*

Aluminum Fuses.

Messrs. Alfred Schwartz and W. H. N. James have been investigating the performance of different fuse metals. In this particular article they give the results of experiments with strip aluminum. With a fuse placed in a horizontal position, the axis of breadth parallel to the ground, a straight-line characteristic is obtained by plotting fusing current and breadth for a constant thickness. On plotting fusing current and thickness for a constant breadth, a curve is obtained which approximates a straight line, with a slight tendency to become concave toward the axis of thickness. The following empirical law has been deduced: $C = K\ (b + b_1)\ (t + t_1)$, in which C is the normal fusing current, b_1 equals 0.035 inch, t_1 equals 0.0024 inch, b and t the breadth and thickness, respectively, and K is a constant. This law holds between the following limits: breadth, 0.15 inch to 0.8 inch; thickness, 0.003 inch to 0.035 inch; current per strip, from twenty-five to 600 amperes. The value of the constant depends upon the position and environment of the strip and the length between terminals and also on the mass and character of the terminals used. If the strip be placed horizontal, with its axis of breadth vertical, the fusing current will be higher than that indicated by the above law, due to the greater facility for cooling. This may be taken as six per cent on an average. If the axis of length of the strip is vertical, and that of breadth horizontal, the fusing current is approximately the same as when horizontal and edgewise. In this respect aluminum differs from copper and zinc. Aluminum attains a dull red heat just before fusion, and a strip which will carry 200 or 300 amperes will, if blown on a low-pressure circuit of ten or twenty volts, throw off burning globules of metal a distance of two or three feet. When the breadth has been cut down for a couple of inches at the centre the portion disrupted is almost entirely limited to this length, but the cutting down must be carried to a greater extent than with zinc. Unfortunately, aluminum, zinc and cadmium are highly electropositive to copper or brass, and in the presence of moisture this, at a difference of potential, is likely to give rise to corrosion. It is therefore advised that the terminal blocks for fuses of these metals be tinned. A diagram is given, showing the conductivity of alloys of cadmium, zinc, tin zinc and lead zinc of varying proportions.—*Abstracted from the Electrician (London), January 5.*

Applications of the Accelerometer.

Some interesting applications of the Owens accelerometer are suggested in *L'Industrie Électrique* (Paris) for December 25. This instrument was described in the issue of the ELECTRICAL REVIEW for December 9. In the article referred to above the operation of the accelerometer is explained and the translator goes on to say that besides its great value for studying traction problems it should be useful in developing automobile design. As the accelerometer is available for measuring negative accelerations as well as positive it can be used for studying braking effects and offers a scientific method of controlling the brakes of a train. By watching the instrument the engineer can tell at any moment the rate of retardation and thus have his train under control.

The accelerometer, when used as an indicator of negative accelerations, can also be applied to determining certain losses in electrical machinery which are now at times measured by the so-called retardation method, in which the retardation is determined by measuring the decrease in speed for an appreciable time. The instrument will also be of value in studying air resistances and the friction of belts and gears.

Electric Power in Germany.

Consul-General Richard Guenther, Frankfort, Germany, has made a report concerning the utilization of waterways in Germany for the production of electric power. The Prussian department of public works has prepared a monograph with reference to the utilization of water power created through the canalization of the rivers Mosselle and Saar. This monograph states that at the dam of the Mosselle river, in Prussian territory, about 35,000 horse-power, and in the territory of Lorraine about 5,000 horse-power, and at the dams of the Saar about 10,000 horse-power will be available—a total of about 50,000 horse-power. This power will not at once be utilized at all the dams. Furnace gases developed in the process of blasting are already used for supplying large amounts of power to the iron furnaces in Lorraine and the Saar district. There is thus a rather unfavorable market in this territory. For such larger cities as Coblenz, Trier and Metz, however, the power of the dams in the vicinity could be used profitably. This water power could also be made use of in running short railroad lines, as, for instance, the recently constructed Mosselle Valley Railroad from Trier to Bullay. The current could be used for navigation in the canal and for operating sluices and guards.

Methods of Getting New Business.

A department devoted to the commercial development of Central Stations. Managers are invited to contribute suggestions for methods of increasing the demand for electric service.

It is a great advantage in securing new business to give the prospective customer accurate knowledge with respect to the cost of using electricity, whether it be for lighting, power or other purposes. General statements as to its economy are not convincing. Figures should be presented and possibly estimates submitted as to the probable cost to him if he adopts the new power.

For example, the People's Light, Heat and Power Company, of Springfield, Ohio, sent out not long since a circular letter stating that it was prepared to furnish power cheaper than the recipient of the letter could make it and that it was in a position to demonstrate this. It enclosed in this letter a postal card for reply, asking that certain questions upon the card be answered. These questions were: "Do you use power in any form?" "What kind of power—electric, steam, gas, water?" "Power used for ————"; and a space to be filled out indicating when a representative of the power company might call. Replies were received from only about five per cent of these letters, so that it was necessary for a representative of the company to call on every one who had received a copy of the letter, nothing having been gained by it.

Bearing directly on this subject are some fliers which are sent out by the Haverhill Electric Company, Haverhill, Mass. Each of these is devoted to some particular phase of electrical application. One deals with the incandescent lamp. It quotes the company's rates for selling power, giving a schedule of the prices. Another explains the advantages of the arc lamp, gives the rates at which they are supplied and cared for, and estimates of the monthly cost of the lamps when used for different lengths of time. It also explains how the customer may estimate for himself what it would cost to light his store or shop with these lamps. This flier states that the company will fit the arc lamps with reflectors and other auxiliary appliances without expense to the customer. A third flier calls attention to the advantages of the turndown incandescent lamp and shows three types of these lamps. Still another flier is devoted to motors. It explains clearly the system of charging for motors and gives a table from which the prospective customer can deduce for himself the cost of running his factory by a motor. It then assumes a number of applications of a ten-horse-power motor: one running for 250 hours per month, one for 126 hours per month and one operated for only one hour during the month. It shows what would be the cost of the service for each case. The cost of running the motors is made up of two items: one, a service charge of $1.50 per horse-power of demand per month, the amount of demand to be determined by the supply company after tests; the second item is the current charge and this ranges from 3.7 cents down to 0.8 cent per kilowatt-hour, according to the amount of power consumed during the month. For customers whose use of power is very irregular—such, for example, as the one quoted above, where the motor was in service for an equivalent of one hour at full load only during the month—a non-contract service is rendered at the regular rates for lighting. A minimum charge for power of $1 per month is made on this basis.

The United Electric Light and Power Company, New York city, also issues circulars showing what would be the approximate cost of electric service for different classes of work. One of these is devoted to domestic appliances, such as broilers, tea-kettles, water-heaters, stoves, foot-warmers, curling-irons, flat-irons, etc. It quotes the price of each article and the operating cost per hour. For example, under the heading of "Broiler" the purchase price is given as $10.80 and the operating cost fifteen cents per hour. This fifteen cents is the cost of running the broiler continuously for one hour, and as few culinary operations require an hour for carrying them out the cost of each use of the broiler will be, in general, considerably less than this; for example, to broil chops requires from four to eight minutes, so that, at the most, the cost of doing this on the electric broiler will not be more than two cents. Flat-irons cost from $4.25 to $5.75, depending on the size. The lighter ones can be operated at two cents an hour, the heavy ones for five and one-half cents an hour. Figures of this kind appeal directly to the householder and undoubtedly have considerably more influence than a general statement of the economy of electric power.

The Philadelphia Electric Company, Philadelphia, Pa., is sending out a mailing folder strikingly got up in red and black. The cut on the first page represents a well-dressed man heaving coal into a furnace door. The caption reads "Quit Heaving Coal." The circular goes on to say: "heaving coal in a frock coat and a top hat looks ridiculous. Is that what you are doing? You can not write letters and shovel coal at the same time. You can't give proper attention to the important details of your business and at the same time be annoyed by the petty troubles of a private power plant. It is no more reasonable to suppose that we can improve on your methods of conducting your business than it is to suppose that you can run a power plant as efficiently or as economically as we run our great power stations. And that is the whole story in a nutshell! You can sell your products cheaper than we can make them—we can sell you electric power for less money than it costs you to generate it. Doesn't the argument appeal to you from a common-sense standpoint? Is it not altogether reasonable? You don't go into the matter blindfolded; we don't ask you to take any risks. We make all the preliminary tests and estimates free of charge, and if you are not convinced on receiving our report all you have to do is to reject it." There is a postal card attached to this circular, which the recipient can use to obtain further information from the supply company.

A system of securing customers which has some advantages is to award the wiring of the houses to local contractors and to charge the tenant a fair rental for it. This induces the local wiring men to canvass the town for subscribers to the benefit of the company. To avoid the expense of installing meters in every house, it is suggested that power be sold at a flat rate, and that the houses be grouped, one meter being installed for each group. The object of this meter is merely to prevent an unnecessary waste, and if the reading at any time is excessive, it is not difficult to detect the extravagant consumer.—*Electrical Review (London)*.

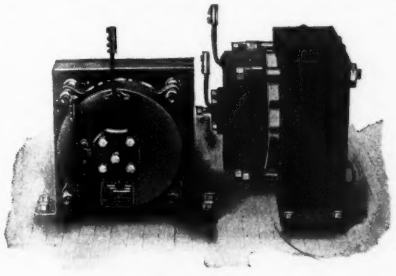
INDUSTRIAL SECTION.

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

A New Magnetic Brake.

A new magnetic brake has been brought out by the Electric Controller and Supply Company, of Cleveland, Ohio. This is designated as the type "Q" brake, and is designed to be used on electrically driven machinery of from one to 100 horse-power.

The type "Q" brake embodies some new and desirable features. Among these are the constant coefficient of friction, the



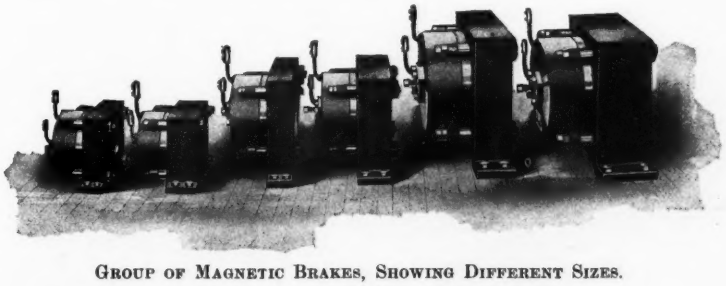
NEW MAGNETIC BRAKE.

easy adjustment for wear, and the means by which the reliability is obtained.

The friction plates of the brakes are of metal running in oil. The stationary plates are square, and are prevented from rotating by studs at the four corners of the friction case. They are free to move laterally. The moving plates are circular, and are supported by and keyed to the hub. They are also free to move laterally. The hub is made of steel, with keys cut from the solid, supported by and firmly keyed to the motor shaft. It is provided with an oil slinger to throw oil inside of the case and prevent it from running out at the hub opening. Lubricating oil for the brake proper is placed in the case to a depth of one-half inch below the lowest point of the hub opening. The moving plates of the brake, dipping into this oil, throw it to the top of the case, from whence it drops back to the friction plates. Thus not only is effective lubrication provided, but the circulation of the oil carries away the heat generated by the friction of the plates.

The electromagnet operating the brake is mounted on the studs which prevent the stationary plates from revolving. The coil of this magnet is form-wound, thoroughly insulated, and dried with a vacuum drying and impregnating process which converts the coil into a solid mass, thus excluding moisture and aiding in the dissipation of heat.

The brake is released by an electromagnet excited by this coil. The magnet acts through a short air-gap, and operates quickly and softly with a small current. The braking force is applied axially and balanced within the frame of the brake, causing no unbalanced thrust on the bearings of the motor. The braking force is always constant, and equally effective with either direction of rotation. The adjustment of the braking force is made easily by simply screwing in or out the adjusting screw in the centre of the spring cover. When the total amount of wear on all the plates is equal to one-quarter of an inch, a new square plate can be placed in the friction case by removing the magnet case and the two studs at the top. The brake releases on one-half full-load current as a maximum. On account of the large pole area, it does not drop back again until the current has fallen to about one-tenth of the full-load value, thus holding off the brake until the current is entirely cut off.

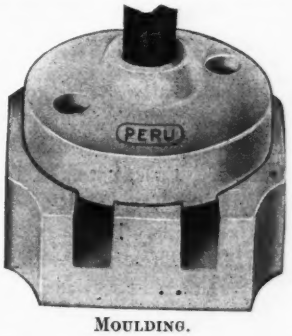


GROUP OF MAGNETIC BRAKES, SHOWING DIFFERENT SIZES.

The brake is protected from the weather by the containing-case, which also protects it from mechanical injury. All parts of the brake are standardized, and are machined from jigs, thus ensuring interchangeability of parts. It is designed in three forms, to meet the service demanded in different classes of electrically driven machinery.

The "Little Twister."

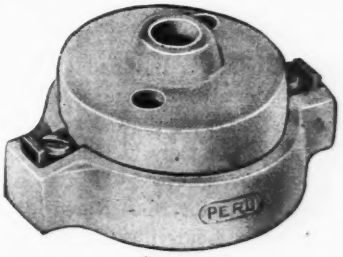
The Peru Electric Manufacturing Company, Peru, Ind., has placed on the market a new line of fuseless rosettes desig-



MOULDING.

nated as the "Little Twister." The name comes from the application, a half turn securing the cap to the base.

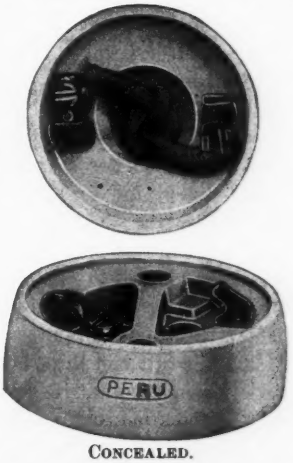
This is a line of small but substantial rosettes, safe in construction, with pro-



CLEAT.

tected terminals and a lock spring preventing the cap from working loose.

The base and cap are made of thoroughly vitrified porcelain with heavy brass terminals. The hole in the cap will take standard reenforced cord, and there is a



CONCEALED.

cavity in the cap accommodating a knot in the cord to take the strain off the terminals.

This line includes rosettes for moulding, cleat and concealed work.

Curtis Steam Turbines in Mining and Railway Work.

The economy of the steam turbine at all loads is leading to its wide adoption for mining power purposes in conjunction with electricity as the intermediary. That the Curtis steam turbo-generator built by the General Electric Company, of Schenectady, N. Y., is meeting with much success in this class of work is shown by the following list of installations where it has been adopted:

Seven 500-kilowatt, 2,300-volt, sixty-cycle alternating-current generators driven by Curtis turbines have been purchased by the Delaware, Lackawanna & Western Railroad Company for operating mining locomotives and hoists in the coal mines at Scranton, Pa. Three of these machines were put in commercial service in November, 1903, and such has been their success that another has since been installed and an order has been placed for three additional machines, which are now being installed at Nanticoke, Pa. Other Curtis turbines in process of construction for coal-mining work are a 500-kilowatt machine at Iron Mountain, N. Y., for the Delaware & Hudson Railroad Company; one 1,500-kilowatt and one seventy-five-kilowatt machines for the Cowanshaunock Coal and Coke Company, at Echo, Pa., and two seventy-five-kilowatt Curtis steam turbo-generators for the North Jellico Coal Company, Louisville, Ky.

One of the most recent adaptations of the turbine in this work is at Flat River, Mo. The Federal Lead Company will install three 500-kilowatt, four-stage, 480-volt Curtis steam turbo-generators. These will operate at sixty cycles and three-phase for lighting and power work in the company's mines. A duplicate exciter system will be furnished consisting of a twenty-five-kilowatt turbo-generator set. In addition to the above, the General Electric Company will also furnish a complete switchboard equipment for a three-phase power feeder system and for four single-phase lighting circuits.

In other countries as well the steam turbine has been adopted to furnish power for mining purposes. The Consolidated Gold Fields Company, of South Africa, has one 1,000-kilowatt and three 500-kilowatt Curtis steam turbines in successful operation. In the same country, also, the Witwaters Rand Deep Mining Company operates a 500-kilowatt turbine, using the power so generated in gold mining. In Japan a 1,000-kilowatt machine has been installed in the Miike Coal Mine.

In electric railroad engineering the steam turbine is meeting with favor also, not only for suburban trolley systems, but in recent developments in the electrification of trunk lines. Power for the operation of the Camden-Atlantic City portion of the Pennsylvania Railroad will be supplied by steam turbines, about 6,000 kilowatts being furnished in Curtis turbo-generators for this purpose.

GROWTH OF THE DEMAND-INDICATOR BUSINESS IN THE UNITED STATES.

BY J. S. CODMAN.

The Wright demand indicator was invented by Mr. Arthur Wright, of Brighton, England, for use with the Wright demand system of charging for electricity.

FIG. 1.—RACKS WHERE TUBES ARE PLACED AFTER THE ZEROS HAVE BEEN DETERMINED.

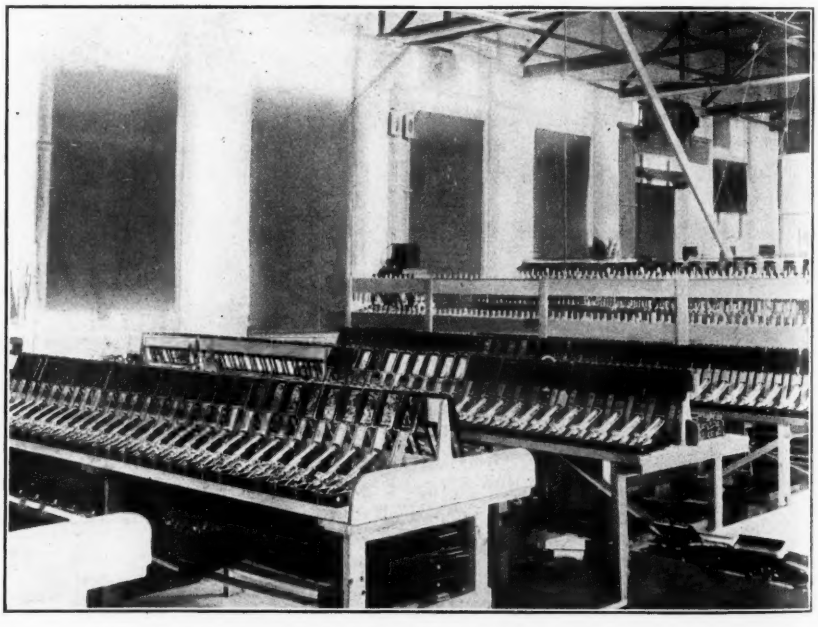


FIG. 2.—ASSEMBLY BENCHES, WITH INDICATORS AWAITING INSPECTION.

This system was introduced in Brighton in 1893 and was promptly followed by increased sales and income, by greatly improved load-factor and by a large increase in the number of long-hour customers.

The first Wright indicator in the

Battery Company Secures New Plant.

The Rock Island Battery Company, Cincinnati, Ohio, whose plant was destroyed by fire January 11, has secured an entirely new factory building and has commenced the manufacture of its dry batteries on a larger scale than ever.

United States was brought over from England in 1896 by Mr. R. S. Hale. In 1897 Mr. Wright himself read before the National Electric Light Association at Niagara Falls a paper entitled "Profitable Extensions of Electricity Supply Stations," in which he outlined his system in detail. This served to focus the attention of central station managers on the rate question and the principles enunciated by Mr. Wright rapidly gained recognition. At the present time a demand system of some form based on these principles is in use in the more prominent cities of the Union, such as New York, Chicago, Boston, Detroit, Cleveland, Cincinnati, St. Louis, Topeka, Denver, St. Paul, Minneapolis, Seattle, Rochester, N. Y., and Springfield, Mass., as well as in a large number of the smaller cities.

The manufacture of Wright demand indicators in this country was begun in 1898 by the General Incandescent Arc Light Company, of New York, which purchased the right from the English company. The business grew rapidly and was transferred to Pittsfield in 1903, where improved facilities were obtained and the present capacity of the works of the Stanley-G. I. Electric Manufacturing Company is 1,000 indicators per week. The business continues to grow, and for the first ten months of the present fiscal year, which dates from February 1, is already thirty-four per cent ahead of last year's total.

Of the illustrations given of the factory at Pittsfield Fig. 1 shows two racks where tubes are placed after the zeros have been determined, and on the right a rack with indicators complete and ready for testing.

Fig. 2 shows some of the assembly benches with indicators awaiting inspection, and Fig. 3 gives a general view of the testing and assembly room with three testing racks in the centre and in the background to the left the zero-setting benches.

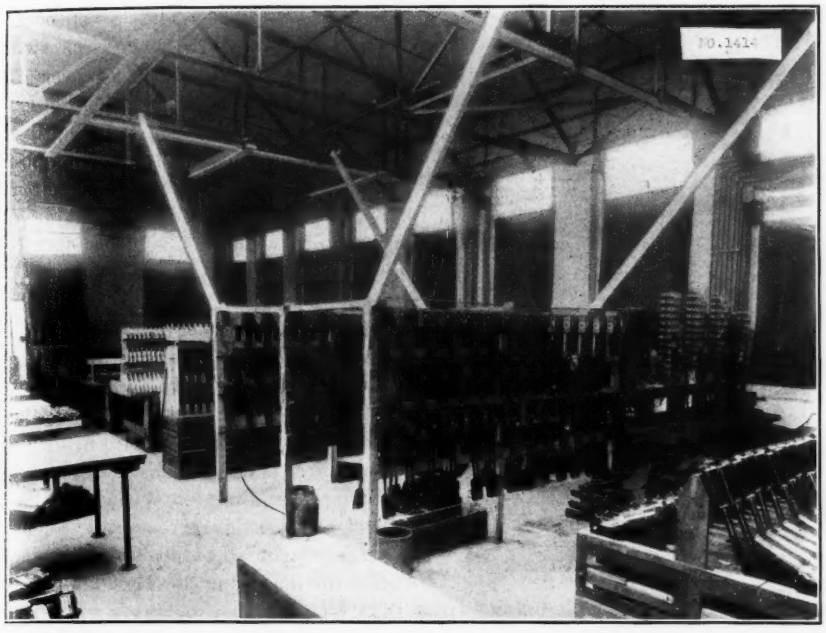
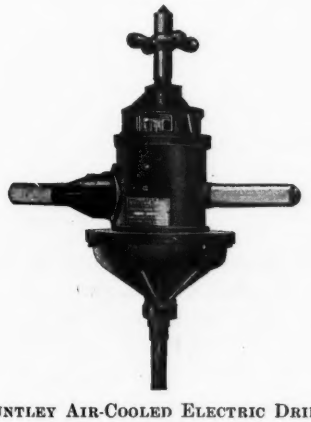
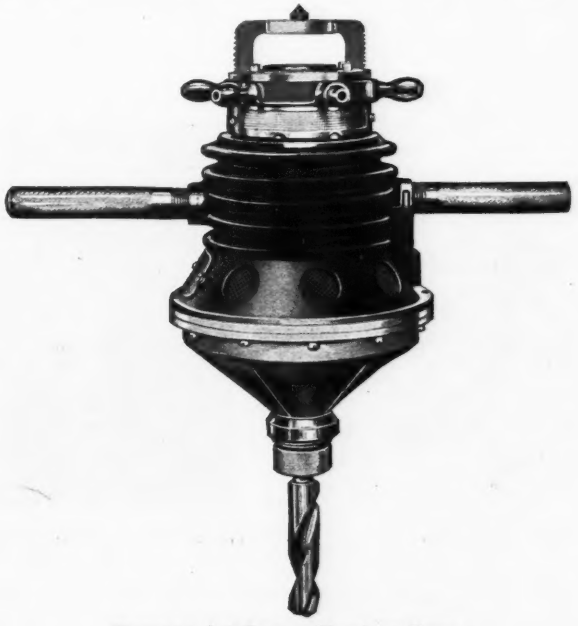


FIG. 3.—GENERAL VIEW OF TESTING AND ASSEMBLY ROOM.



DUNTLEY AIR-COOLED ELECTRIC DRILL.



DUNTLEY AIR-COOLED ELECTRIC DRILL.

The Chicago Pneumatic Tool Company's Electric Drills.

The accompanying illustrations show two types of the "Duntley" air-cooled portable electric drill manufactured by the Chicago Pneumatic Tool Company, Chicago, Ill.

"Duntley" air-cooled portable electric drills are made in six sizes, ranging in capacity from three-eighths of an inch to two and one-half inches in steel. The large and varied experience of this company in the portable compressed-air tool business has been made use of in the designing of these electric drills, resulting in many important features and improvements exclusively its own.

All of the windings of the drills are kept extremely cool under the heaviest work by means of forced circulation of air from fans revolving on the armature shafts. The planetary system of gearing is used, resulting in absolutely balanced strains on the bearings and great mechanical strength, with little wear on the gears. The pinion on the armature shaft is an integral part of the shaft, and all of the gears are hardened, thus reducing

wear to a minimum. So nicely balanced are the mechanical parts, the gears, as far as possible, interchangeable with their air drills and the electrical design so well carried out, that a drill having a capacity of one and one-quarter-inch hole will run at full speed with a current consumption less than that of a thirty-two-candle-power incandescent lamp.

Drills of one and three-quarters inches capacity and over have their armatures all geared to the drill spindle by means of planetary gearing. By means of this arrangement of armature and fields compactness and high power have been obtained, making a portable electric drill of remarkable efficiency.

A magnetic "old man" is used with these drills. This is used entirely without bolts, the magnetic force being sufficient to hold it to the work against the pressure of the feed screw of the drill. The same current as is used in the drill is employed to produce the magnetic effect.

Special Holophane Reflectors.

The Holophane Glass Company, New York, N. Y., has placed upon the market special reflectors for eight, ten, sixteen and thirty-two-candle-power clear and frosted lamps.

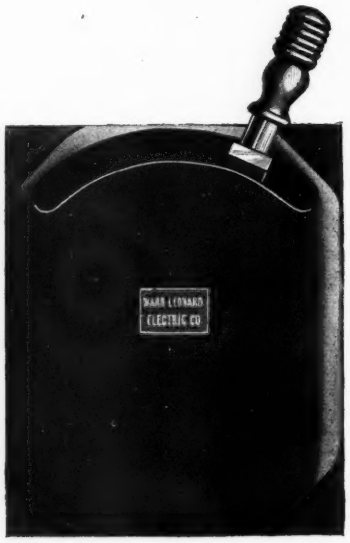
A great deal of time and effort has been spent in the past in producing efficient combinations consisting of scientific prismatic reflectors and high efficiency lamps.

The sales department of the Holophane Glass Company has gone a step further and taken hold of the smaller units and designed some very effective shades to be used in this connection, making six styles, three of which are used for concentrating the light and three of which are used for distributing the light. In one instance the downward light is said to be increased almost 800 per cent over that of the bare lamp. These reflectors are made to fit standard two and one-quarter-inch holders, are graceful in design, presenting a very pretty appearance when used as shown in the illustration.

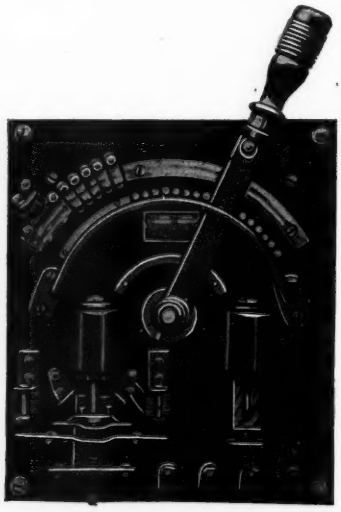
SPECIAL HOLOPHANE REFLECTOR.

A New Motor-Speed Controller.

An improved type of reversing motor-speed controller has been brought out by the Ward Leonard Electric Company, Bronxville, N. Y. This device controls both the armature and the field of the motor on forward speeds and the armature on reverse speeds. It is fitted with automatic no-voltage release with an overload circuit-breaker, and with remote-control push-buttons, enabling the operator to stop the motor from any desired point.



REVERSING MOTOR-SPEED CONTROLLER—WITH COVER.



REVERSING MOTOR-SPEED CONTROLLER—WITHOUT COVER.

This controller is designed to meet very severe requirements. The requirements of machine-tool and printing-press duty require that there shall be provided an automatic quick-acting solenoid switch, "making" and "breaking," the main-line circuit, the coil of which should be entirely dependent upon the line voltage and independent of the armature currents or field-currents. A further requirement is that this switch should not close until the lever controlling the resistance is in a position where the armature will not be short-circuited. The remote-control system will open the main line switch by breaking a circuit of not over one-tenth of an ampere, after which the main switch can not be closed again until the lever has been moved to the starting point. It is required that the overload circuit-breaker should operate by breaking the circuit of the main line solenoid switch, thereby causing the switch to open.

The requirements for the controlling resistance are also severe. This resistance is capable of carrying the full-load current continuously without undue heating. When cold it will stand, without injury or alteration, a current of fifty per cent in excess of the full-load motor current for five minutes. When cold it will stand, without injury or alteration, a current double the full-load motor current, for one minute. The conductor is of a metallic alloy having a high-fusing point. The temperature coefficient is low and does not alter greatly when heated. This resistance is supported mechanically by the insulating material which surrounds it, so that in case the conductor be melted by excessive current it can not move. The controlling arm for the resistance does not carry current and is not alive. It is simply a carrier for the insulated, movable contacts.

The movable contacts themselves are easily renewable, are self-aligning and self-adjusting and ride over any projection not more than one-sixteenth of an inch above the surface of the contact segments. The main line solenoid switch is of the laminated type, having two contacts of the double-break type. There are two auxiliary breaking devices for each contact, the final breaks being fitted with magnetic blow-outs.

New York State Electrical Contractors' Association.

About 100 delegates from various parts of the state attended the annual meeting of the New York State Electrical Contractors' Association at the Iroquois Hotel, Buffalo, N. Y., January 16. An executive session and general meeting were held during the morning and afternoon. In the evening a banquet was held at the Iroquois, H. I. Sackett, of Buffalo, acting as toastmaster.

CURRENT ELECTRICAL NEWS

DOMESTIC AND EXPORT.

LARGE MORTGAGE FILED—The Trenton, Lakewood & Atlantic Railway Company has recorded a mortgage for $2,500,000 executed to the Standard Trust Company, of New York. The mortgage is to cover a proposed issue of forty-year five per cent bonds. The company was formed to construct a direct trolley line from Trenton, N. J., to the New Jersey shore.

TO BUILD LARGE ELECTRIC PLANT—It is reported that a company with a capital of $2,000,000 has purchased the falls of Roanoke river in Mecklenburg at Eagle Point, about ten miles below Clarksville, Va., and proposes to establish an electric plant to furnish light and power to towns, mills and factories within a radius of fifty miles in Virginia and North Carolina.

MUNICIPAL LIGHTING IN SEATTLE, WASH.—A newspaper despatch from Seattle, Wash., states that a few months' experience with the city-owned lighting plant has proved it a failure. On February 1 the funds will be depleted. This condition is brought about by the fact that the revenues from commercial lighting during December amounted to only $824. It costs $2,000 a month to operate the plant. This does not include the replacing of worn-out material nor the adding of new apparatus. Nearly $750,000 has been spent in the construction of the plant. The free light furnished for municipal purposes is not very extensive. The lighting department declares that at the next election the voters must put through a $1,000,000 issue of bonds, or the plant will be shut down.

APPLICATION FOR ANNULMENT DENIED—Attorney-General Mayer has denied the petition of Abraham Sartorius for permission to bring proceedings to annul the charter of the New York Electric Lines Company, under which the Great Eastern Telephone Company proposes to establish an independent telephone service in New York city. He ruled that the respondent company has maintained its right to corporate existence, although it has taken no supplementary step toward exercising its rights. The company has elected the following directors: George R. Bidwell, William Graves, Richard M. Montgomery, Wayne W. Wilson, Edward M. Millard, Herman G. Loew, Percival E. Jones, D. A. Reynolds and George Riley. The board elected William Graves president, Herman G. Loew vice-president, Wayne W. Wilson secretary, D. A. Reynolds treasurer and George R. Bidwell manager.

MEXICAN ELECTRICAL NOTES—La Electra, the Spanish light and power and street railway company of Guadalajara, is planning to develop power along the Santiago river between Las Juntas and San Cristobal for the purpose of transmitting current to Aguascalientes. Engineers have been employed to report on the project. The Facundo Perez water concession, covering the Santiago river between Las Juntas and San Cristobal, a distance of forty-five kilometres, was recently purchased by La Electra for $125,000. It is estimated that at least 30,000 horse-power can be developed. The distance from the Santiago river at San Cristobal to Aguascalientes is something over 100 miles. A movement is said to be on foot to build an electric railway from Balsas, the terminus of the Mexican Central, to Chilpancingo, the capital of the state of Guerrero. The road would be about forty miles in length, passing through a mountainous district. The cost is estimated at $300,000.

CHICAGO CARS STOPPED—Maurice F. Doty, traction expert for the city of Chicago, stopped traffic on January 17 on two cable lines running on Wabash avenue and State street, Chicago, Ill. Both lines are owned by the Chicago City Railway Company. The reason given by Mr. Doty is that the passengers are in danger because of the gates on the left side of the cars being left open while the cars traverse two squares on Wabash avenue between Randolph and Madison streets. After conference with the mayor the cars were allowed to run as before. The tie-up on both lines continued for a little over two hours. Suits have been filed by the city in the circuit court against the Union Traction Company for $1,500,000, and against the City Railway Company for $500,000, for alleged violations of city ordinances. The actions are based solely on overcrowding of cars in December. There are 15,000 cases against the Union Traction Company and 5,000 cases against the City Railway Company, and in each case the maximum fine provided in the ordinances—$100 for each violation—is asked.

CHICAGO & SOUTHERN TRACTION COMPANY BORROWS $2,000,000—It is announced that the Chicago & Southern Traction Company has obtained a loan of $2,000,000, secured by a thirty-year trust deed at five per cent given to the Western Trust and Savings Bank, Chicago, Ill. The loan is in the nature of a bond issue, and $800,000 will be issued at once. The Chicago & Southern Traction Company is a new Indiana corporation, first capitalized at $2,000,000, and has taken over the Indianapolis, Lafayette & Western Traction Company and other recent Indiana corporations. It has also absorbed the Chicago Electric Traction Company, and is constructing a permanent way in the gaps that remain to be filled between Chicago and Indianapolis. New York, Chicago and Indianapolis capitalists are interested in the proposition, which will eventually involve about $75,000,000. Of the roads now concerned in the proposed merger a capitalization of approximately $20,000,000 and a mortgage and bonded indebtedness of about $23,500,000 are represented. The chief promoter of the plan of a continuous trolley between Chicago and New York is William S. Reed, of Chicago, and the first step in the matter was taken last fall, when arrangements were made for the purchase of the Chicago Electric Traction Company. The other members of the promotion committee are Isaac L. Rice, Samuel R. Shipley and George H. Day.

NEW PUBLICATIONS.

UNITED STATES GEOLOGICAL SURVEY—The United States Geological Survey, Department of the Interior, Washington, D. C., has issued a report upon the mineral resources of the United States, for the calendar year 1904.

THE SCIENCE YEAR BOOK—"The Science Year Book for 1906," edited by Major B. F. S. Baden-Powell, has just come to hand. This is the second issue of this useful and helpful handbook. It consists of a diary, a directory of scientific societies, and an astronomical calendar, and contains as well a series of reviews covering all branches of science. Among those contributing to this part of the work are Professor A. C. Haddon, E. W. Maunder, Dr. Gilbert T. Morgan, Dr. William J. S. Lockyer, Professor W. E. Ayrton, who gives a review of electrotechnics; Professor J. D. Cormack, who reviews engineering in general, and A. W. Porter, who gives a summary of physical science. There is a short department entitled "Glossary of Recently Introduced Scientific Terms and Names." The caption is somewhat misleading, for this section is by no means complete and contains, as well, terms which have been long in use; such, for example, as "atom" and "series motor." The list of books for the year is also far from complete, as there are but four works on engineering mentioned. This is surprising, considering the rate at which technical books are being turned out. The list of scientific and learned societies for Great Britain seems to be complete, but the coresponding list for the United States is defective; for example, such bodies as the American Society of Mechanical Engineers and the American Electrochemical Society are not mentioned. There is a bibliographical directory which is very good so far as it goes, but it is devoted principally to English men of science. The second half of the book consists of a diary for the year, which should be of particular value to those interested in astronomy. The book contains, as well, the usual tables of weights and measures, and physical data. While not a book appealing particularly to the engineer it should be helpful to those who devote their time to science. This work is published by King, Sell & Olding, Limited, 27 Chancery lane, London, W. C. The price is five shillings, foreign postage twenty cents. Any page will be furnished separately for two cents.

TELEPHONE AND TELEGRAPH.

COVINGTON, KY.—Work has been started on a new telephone line from Sparta to Covington.

FINDLAY, OHIO—The Arcadia Mutual Telephone Company has decided to build a toll line to Van Buren.

BELFAST, ME.—The Liberty & Belfast Telephone Company is making extensive additions to its Morrill line.

DETROIT, MICH.—The Sandusky (Mich.) Telephone Company is planning to put in a city and rural telephone line.

SAN DIEGO, CAL.—The Home Telephone Company has placed in operation its extensions to Coronado and National City.

JEFFERSON, OHIO—The Jefferson Citizens' Telephone Association has been formed to establish an exchange and connect with rural telephone lines in the adjacent and surrounding counties.

CAMDEN, N. J.—The board of freeholders has passed a resolution giving the Delaware & Atlantic Telephone Company the privileges of laying conduits from Haddon Heights to the old borough line of Haddonfield.

GREENSBURG, IND.—The Converse Telephone Company, which for the past five years has been a sublicensee of the Central Union Telephone Company, has severed its connections with the Bell interests and now connects with the independent systems.

SEDAN, KAN.—The Missouri & Kansas Telephone Company has bought out the Dosbrough Telephone Company's lines. The sale includes the local plants at Caney, Peru, Sedan, Cedarvale, Hewins, Elgin and Chautauqua. The old company also had toll lines all over the county, west to Dexter in Cowley county and to Pawhuska, Osage nation.

PITTSBURG, PA.—A most extensive system of telephones has been put into service by the Pittsburg Coal Company and its allied and subsidiary companies. A total of 139 miles, with a large number of stores, machine shops, railroad offices, etc., as well as the general offices, are now connected by the one telephone company. For this purpose over 500 miles of line were used.

UTICA, N. Y.—The Utica Home Telephone Company has elected the following officers; directors, Edgar B. Odell, Henry F. Miller, Edward L. Barber, of Wauseon, Ohio; George R. Fuller, of Rochester; Eduard Bushinger, T. Harvey Ferris, T. S. Lane, of Rochester; William I. Taber, of Herkimer, and Charles H. Poole. E. B. Odell was elected president, Henry F. Miller vice-president, Eduard Bushinger treasurer and Charles H. Poole secretary and general manager.

NEW YORK, N. Y.—Fire Commissioner O'Brien has given orders for the installation of telephones in all the engine houses in Manhattan and the Bronx so as to supplement the present fire-alarm system. Every engine house in the two boroughs will be connected by telephone with police headquarters and also with fire headquarters. There will also be connection with the public system. In case of an accident to any part of the wires of the signal system the telephone can be used to notify the department of fires and to call out the engines.

MANSFIELD, OHIO—At the annual meeting of the stockholders of the Mansfield Telephone Company the following board of directors was elected: B. J. Balliett, John L. Baxter, A. B. Beverstock, Frank W. Bloor, Louis Brucker, F. M. Bushnell, A. L. Cameron, Reid Carpenter, S. N. Ford, W. E. Loughridge, W. B. Martin, Burton Preston, J. A. Rigby, C. W. Upson, M. D. Ward. The board of directors organized by reelecting the present officers: S. N. Ford, president; John L. Baxter, vice-president, M. D. Ward, secretary and treasurer, and S. E. Ward, manager. A dividend of two per cent was declared. A report was made showing that the company has in operation 3,300 telephones.

TROY, N. Y.—Excellent telephone service is now provided for residents of the towns and villages in Washington county and the north by the Hudson River & New England Telephone Company, which operates in territory recently sublicensed by the Granville Telephone Company. Direct communication is obtainable with all the large cities and towns of the county by people in Granville, Middle Granville, North Granville, West Granville, South Granville, Cambridge, Shushan, Salem, Pawlet, Hartford, Hebron, West Hebron, West Pawlet, Rupert, West Rupert, Lake St. Catherine, Truthville, Slateville, Slyboro, Raceville, Comstock's and Fort Ann.

BRIDGEPORT, CT.—The Southern New England Telephone Company made the past year the banner one in its history so far as new work is concerned. The extension of its lines throughout the state and the installation of new telephones have been unprecedented. In the aggregate 8,000 new telephones have been put in by the company, making a service of upward of 41,000 at the present time. The reduced rates in the cities of Bridgeport, New Haven and Hartford went into effect January 1, and the current year will see a notable increase in the installation of new instruments in these cities. The company's plans for the new year contemplate the largest amount of work that has been undertaken in any single year since its organization.

AUGUSTA, GA.—The Postal Telegraph company has instituted legal proceedings to secure condemnation of a right of way for the company on the right of way of the Georgia Railroad between Augusta and Atlanta, and Macon, the increasing business of the Postal company making it necessary for it to own its own line between Augusta and Atlanta and between Augusta and Macon. According to the petition the Postal desires to use the right of way of the Georgia road from the Gwinnett street crossing in Augusta, through the counties of Richmond, Columbia, McDuffie, Warren, Taliaferro, Green, Morgan, Walton, Newton, Rockdale and DeKalb, at a point near the line of Fulton and DeKalb counties near Atlanta; also from Camak, Warren county, westward, through the counties of Warren, Hancock, Baldwin, Jones and Bibb into Macon as far as the road's right of way extends.

PROVIDENCE, R. I.—Substantial additions to the real estate holdings of the Providence Telephone Company were made during 1905. The central exchange on Union street was remodelled and enlarged, and with two additional stories the company has excellent offices for the various administrative departments and room for a new switchboard having a maximum capacity of 9,600 lines. The enlargement of the Broad street exchange increased its capacity 150 per cent, and the new buildings and additions provided for Newport, North Attleboro and Narragansett Pier, while not included in Providence real estate transactions, have a direct local bearing, in that they enable Providence people to communicate with a large number of new subscribers, and thus augment the value of the service. Land for new exchanges has been purchased in Olneyville, Warren, Pawtucket and East Providence.

BINGHAMTON, N. Y.—Plans are said to be under consideration for the consolidation of the long-distance lines of a number of independent telephone companies, including the York State Telephone Company, which operates the exchanges in Binghamton, Elmira and other places. These plans have not been developed sufficiently so that any details can be given, nor can it be said how many companies will be included in the consolidation. According to the present system there are a large number of separate independent telephones, many of them having interurban connections and which have working agreements whereby long-distance service is furnished. These long-distance connections are under many managements at present. The plan under consideration is to unite all of them under one management. In this manner and by building some of the connecting links that are still lacking it is thought that the service can be much improved.

NEW HAVEN, CT.—The Southern New England Telephone Company will make another increase in its capital stock next July by an issue of 5,000 shares of stock. This will be offered to the stockholders of the company on the same basis as previous issues of stock, namely, at par of $100 a share. It will be the first issue of stock to be made by the company since the rights were given by the general assembly to the company to increase its capitalization to $10,000,000. The present capitalization is $5,000,000. This amount was reached last fall, the company having been making increases from time to time during the past four years from $3,000,000. In view of the important improvements now being made President Morris F. Tyler asked the general assembly at the last session to give the company higher capitalization. The annual meeting of the stockholders will be held on Tuesday, January 30, when arrangements will be made for the issue of the new stock.

ELECTRIC LIGHTING.

FULTON, KY.—H. F. Oliver has sold his interest in the Electric Light and Power Company to J. H. McClure for $10,500.

CANNELTON, IND.—Fire partially wrecked the city's electric light plant, entailing a loss of $2,300. The insurance is $1,000.

TROY, N. Y.—A new electric light plant is now being erected at Luzerne to furnish light for the village of Corinth. The Corinth plant will be operated by water power from Palmer.

FRANKLIN, PA.—The Franklin Extended Electric Company has been reorganized and the following officers elected: president, Jacob Custer; secretary, N. P. Shaffer; treasurer, Joseph Cauffel.

CLEVELAND, OHIO—The Cleveland Electric Illuminating Company will supply arc lights to the city at $69.72 per lamp during 1906. This is a drop of $3.84 from last year's rate, which was $73.56.

MARION, N. C.—Local parties have let to W. W. Lotspeich, Asheville, N. C., the contract for the construction of an electric light and power plant. Charles E. Waddell, Biltmore, N. C., is consulting engineer.

CHESTER, PA.—The stockholders of the Chester Electric Light and Power Company have elected officers as follows: president, John B. Black; secretary, Thomas A. Hall; treasurer, B. Hilyard Sweeney.

LEBANON, PA.—At the annual meeting of stockholders of the Edison Electric Illuminating Company, these directors were elected: John A. Rigg, W. A. Rosen, Walter A. Rigg, Isa I. L. Jones, W. R. McIlvaine, Joseph L. Caven and K. A. Fichthorn.

WILMINGTON, DEL.—The Delaware Water Improvement Company has contracted with the post commander at Fort DuPont to light the reservation by electricity. Fourteen hundred incandescent lamps of sixteen and thirty-two candle-power will be used.

WASHINGTON, PA.—At a meeting of the stockholders of the Washington Electric Light and Power Company the board of directors for the year 1906 was elected as follows: B. M. Clark, John R. Kuntz, John W. Donnan, A. M. McElroy, J. Y. Scott, James Kuntz, Jr., and J. L. Thistle.

MUSKEGON, MICH.—The American Light and Traction Company has purchased the properties of the Lacomb Electric Company, of Denver, Col., and the Muskegon Traction and Light Company, of Muskegon, Mich. The system of the latter property consists of gas and electric light plants and a street railway.

ROCK HILL, S. C.—The control of the Rock Hill Water, Light and Power Company has passed to the Carolina Power Company. The Carolina Power Company now has control of the plants in Florence, Darlington and Marion, S. C. The water, light and power company has for the past ten or twelve years had control in Rock Hill.

ALTOONA, PA.—At a meeting of the stockholders of the Citizens' Electric Light Company a vote was taken on the proposition to bond the plant for $100,000, increasing the capital of the company to that amount. The vote stood 1,974 for the loan and 199 against it. With the additional capital the company will extend its lines.

ALBANY, N. Y.—In the matter of the application of the Goshen Illuminating Company, of Goshen, the state gas and electric commission has granted a certificate of authority to transact business and to issue $15,000 of bonds and $15,000 of stock. The application asked for consent to issue $15,000 of stock and $20,000 of bonds.

EDWARDSVILLE, ILL.—Edwardsville has granted a fifty-year franchise to Congressman W. B. McKinley, of Champaign, to furnish electric light and power, steam heat and power, and gas for fuel and illuminating purposes to the city. The McKinley syndicate has also secured an option on the Edwardsville Light and Power Company's plant.

TOPEKA, KAN.—At a meeting of the directors of the Topeka Edison Company the old officers of the company were reelected as follows: president, L. E. Myers; vice-president, W. H. Wilson; secretary, A. H. Purdy; treasurer, George B. Caldwell. The company purposes installing next month two new dynamos with a combined capacity of 1,500 horse-power.

BRADFORD, PA.—At the annual meeting of the Bradford Electric Light and Power Company the following officers were elected: president, George H. Potter; vice-president, D. W. Robertson; secretary and manager, J. H. Rose; treasurer, Frank Hamilton. The directors chosen were George H. Potter, D. W. Robertson, J. H. Rose, John Fitzgibbon and John Scott.

WALLA WALLA, WASH.—The Northwestern Gas and Electric Company, of Walla Walla, of which Isaac Anderson, of Spokane, is president, has voted to increase its capital stock from $650,000 to $1,000,000. This money is to be used in improving its plant on the Walla Walla river and in providing more electricity for manufacturing establishments in Walla Walla and Pendleton.

SARATOGA SPRINGS, N. Y.—The Saratoga Gas, Electric Light and Power Company has reelected the following: president, Edgar T. Brackett, of Saratoga Springs; vice-president, Eugene L. Ashley, of Glens Falls; secretary, Elmer J. West, of Glens Falls. The other directors include Hiram C. Todd, of Saratoga Springs; Charles E. Parsons, of Albany, and Walter Trumbull, of Salem, Mass.

HOLLIDAYSBURG, PA.—These officers of the Hollidaysburg Electric Light and Power Company were elected at the annual meeting: president, James W. Gromiller; vice-president, W. H. Markland; secretary and treasurer, John W. Cliber; superintendent, William A. Frank; board of directors, J. W. Gromiller, W. H. Markland, O. P. Brush, J. W. Goodfellow, the Hon. J. Lee Plummer, J. L. Hartman.

HARRISBURG, PA.—The York Haven power plant has completed its line to Middletown, and power has been turned on. From Middletown the line will be pushed to Steeltown as rapidly as possible, the poles already having been erected to the lower end of Highspire. It is said that when the line is completed to Steeltown and the substation erected and furnished the work will represent an outlay of $100,000.

BETHLEHEM, PA.—At the annual meeting of the stockholders of the Bethlehem Electric Light Company the following board of directors was elected: James Thomas, of Catasauqua; Andrew S. Keck, W. S. Hall, C. N. Wagner and H. C. Trexler, of Allentown, and Truman M. Dodson and C. A. Wolfe, of Bethlehem. After adjournment the board organized by electing Mr. Trexler president and Mr. Wagner secretary and treasurer.

PASSAIC, N. J.—The city council of Passaic, N. J., has awarded to the Public Service Corporation a five-year contract for lighting the city. The price for arc lights is reduced from $105 to $85, of street incandescents from $18 to $15 and incandescent service for public buildings from eighteen cents to ten cents per kilowatt-hour. Incandescents for private use are to be twelve cents for the first two years, eleven cents for the next two and ten cents thereafter.

PORTLAND, ORE.—The Mount Hood Electric Company, which is establishing a large power plant at the junction of the Sandy and Bull Run rivers, is to reach the boundaries of Portland within six months with its wires. Active work is now progressing on the canal which will convey the water from the Upper Sandy to the location of the plant and, barring any unexpected delay, the plant will be completed in eight months and in operation inside of one year.

CAMDEN, N. J.—Acting upon the suggestion contained in the first annual message of Mayor Ellis, the Camden council has taken steps toward providing a municipal lighting plant for the city at the expiration of the present contracts. With a view of ascertaining the cost of such a plant and the probable time which would be needed to construct it, the council passed resolutions calling upon the city solicitor for information as to necessary legal steps, and upon the city engineer as to the probable cost of a site and the length of time necessary to build and equip such a plant.

KEARNEY, N. J.—The Kearney common council has instructed the town attorney to prepare a bill to be presented to the legislature which will empower the council to bond the town for the erection of a municipal lighting plant. The Public Service Corporation now lights the streets of the town and is paid $100 a year for arc lights and $16 for incandescents. The contract expired last August and since that time the council has refused to renew it or enter into a new one. It is proposed to erect the plant at the foot of Johnson avenue, along the Erie railroad and Passaic river, on land owned by the town.

ELECTRIC RAILWAYS.

PEORIA, ILL.—The McKinley Traction Syndicate is preparing to extend its lines from Illinois into Indiana. It is proposed to run the line through West Lebanon, Williamsport and Attica.

LANSING, MICH.—The Platt Heat and Power Company has secured practically all of the right of way for the Grand Ledge electric railroad, and announces that the road will be built during the year.

ROCHESTER, N. Y.—The contract for building the Rochester, Syracuse & Eastern electric road from Lyons to Port Byron, twenty-two miles, will be let by the Syracuse Railroad Construction Company before April 1.

SHARON, PA.—At the annual meeting of the Sharon Railway Company the following officers were elected for the ensuing year: president, Simon Perkins, Sharon; secretary, G. A. Richardson, New York; treasurer, P. A. Higgs, Sharon.

SAN FRANCISCO, CAL.—The Northern Electric Company, which proposes to build a standard gauge railroad from Chico to Oroville, Cal., with various extensions to other towns, has doubled its capital, making it $6,000,000, and authorized $6,000,000 bonds for construction.

CRIPPLE CREEK, COL.—Amended articles for incorporation have been filed by the Pueblo Suburban Traction and Lighting Company. The amendment authorizes an issuance of 10,000 shares of preferred stock with a par value of $100 each. This will do away with the issuing of bonds.

BLOOMINGTON, ILL.—Holdenpyl, Walbridge & Company, of New York, which bought the Bloomington & Normal Street Railway heating and lighting system for $1,000,000, have sold the property to the McKinley syndicate, which is building and operating interurban lines throughout Illinois.

MOUNT STERLING, KY.—The city council of Mount Sterling has granted a franchise for a street railway to Younger Alexander, J. M. Bigstaff, W. A. Thomason and others. This franchise assures the building of the Paris and Mount Sterling interurban lines, and the survey will be begun at once.

KNOXVILLE, TENN.—The Knox county and Blount county courts have voted a franchise to the Knoxville-Maryville electric line which it is proposed to build between Knoxville and Maryville, the county seat of Blount county. The road has already been chartered. Cincinnati capitalists are behind it.

ANNISTON, ALA.—At a meeting of the city council of Oxford the Anniston Electric and Gas Company was granted a franchise for building an electric road to Hobson City. Application will later be made to the local authorities of Hobson City for a franchise for the purpose of extending the line to Hobson City park.

HUTCHINSON, KAN.—Emerson Carey, K. E. Sentney and Charles Williams, representing local capitalists, have purchased the Hutchinson Street Railway Company and will change the present horse-car line into an electric street railway. A company is being formed to finance the road, and it is expected that the change will be made next spring.

JOLIET, ILL.—The Joliet & Southern Traction Company has been granted a fifty-year franchise by the board of highway commissioners to build and operate an electric railway. This is the company which is promoting an electric line from Joliet to Dwight, to go through the counties of Will, Grundy and Livingston, and with branches to Morris, Coal City and South Wilmington.

HIBBING, MINN.—Work will begin at once on the construction of a trolley line from Biwabik to Hibbing, the funds having been secured by sale of bonds. The range towns which will be tapped by the new line in their order from Biwabik are: McKinley, Elba, Sparta, Eveleth, Virginia, Mountain Iron, Buhl, Chisholm, Hibbing and Mahoning location. The road will cost $800,000 and will be known as the Missabe Range Traction Company.

READING, PA.—At the annual meeting of the East Reading Electric Railway Company the following were elected as directors: George W. Bard, A. J. Brumbach, Jonathan G. Leinbach, J. A. Strohecker, Frank P. Esterly, William R. McIlvain and William McIlvain. The board reorganized by electing the following officers: president, A. J. Brumbach; vice-president, Jonathan G. Leinbach; secretary, William R. McIlvain; treasurer, A. Raymond Bard.

WILMINGTON, DEL.—Announcement has been made that work will soon be commenced on the line of the Delaware Interurban Railway, which will extend for the present from Wilmington through Elsmere, Marshallton and Newark to Elkton. In order to secure the bonds which will be issued the company has filed a mortgage for $600,000 to the Equitable Guarantee and Trust Company. Western capital has been obtained. At least 20,000 people live on the route of the proposed railway and it is intended to carry freight as well as passengers.

HAGERSTOWN, MD.—The Cumberland Valley Railroad Company has a large force of men at work on the erection of a power-house near Chambersburg. In addition to furnishing current for power and light at the shops of the company it will be used to operate the cars on the Greencastle & Chambersburg trolley line. Power will also be used for the operation of electric cars over the steam road known as the Waynesboro branch. If the latter prove satisfactory electric cars will likely be run over the South Penn road. The plant will cost about $100,000.

LOUISVILLE, KY.—Improvements and extension involving an expenditure of not less than $750,000, and possibly $1,000,000. are to be made by the officers and directors of the Louisville Railway Company this year. The plans, as outlined, comprehend the addition of a large storage battery installation to the power equipment; the extension of the Eighteenth-street-road line four miles beyond its present terminus; the probable extensions of all the interurban lines of the company; the purchase of a large number of new cars of the latest design and largest capacity, and the building of ten miles of new lines in the city.

FLORENCE, COL.—The city council has granted a twenty-five-year franchise to F. S. Granger, of San Diego, to operate a street car line in Florence. With the approval of this street car franchise a complete system for Fremont county is assured, as a franchise was granted by Canon City some weeks ago. Mr. Granger guarantees to start work in six months and to have the line completed in one year. He pays the city two per cent of the gross earnings after 1911. An extension of the system will be made to the outlying coal camps, including Williamsburg, Rockvale, Coal creek and Radiant. The latter is seven miles from Florence.

BOSTON, MASS.—A. B. Turner, of Boston, representing a number of American capitalists, recently secured a charter from the Canadian government for an electric railway to run parallel with the St. Lawrence river and lake Ontario from Cornwall to Toronto. Mr. Turner also obtained a provincial charter for a road from Ottawa to Brockville. It is said that nearly every town council and township board along the contemplated route expressed a willingness to subscribe for any bonds that might be offered. Power will be derived from the falls at Trent river. Both passengers and freight will be carried, the latter, however, being transported at night.

DENVER, COL.—It is announced that the Westinghouse company will build an electric line between Denver and Leadville, The electric service will form a network of lines around Leadville, touching many mines. A tunnel will be driven through the Mesquite range. H. T. Herr, who has resigned as acting general superintendent of the Denver & Rio Grande, will have charge of construction of the new electric lines. The distance will be by electric from Denver to Leadville 115 miles, compared with 151 by Colorado & Southern, 209 by Colorado Midland and 275 by Denver & Rio Grande. Two power-houses will be erected, one near Denver and the other near Leadville.

SHENANDOAH, PA.—The following directors were elected at the annual meeting of stockholders of the Schuylkill Railway: G. H. Gerber, of Reading; MacHenry Wilhelm, W. S. Leib, Ashland; J. S. Housenick, John Mieldazis, Dr. D. J. Langton, Shenandoah; Dr. J. C. Biddle, Fountain Springs; Dr. C. A. Bleiler, Frackville; Dr. G. K. Binkey, Orwigsburg; Alex Scott, Frackville. The directors organized by electing the following officers: president, G. H. Gerber; vice-president, Dr. J. C. Biddle; secretary, MacHenry Wilhelm; treasurer, Dr. D. J. Langton. The directors and officers discussed extensions and improvements, and it is understood that considerable work will be done as soon as the weather permits.

PERSONAL MENTION.

CAPTAIN W. L. CANDEE, manager of the Okonite Company, New York, and Mrs. Candee sailed on the Majestic on Wednesday. Mr. and Mrs. Candee will be gone about a month visiting London and Paris.

MR. E. J. KULAS, manager of the Brilliant Electric Company, Cleveland, Ohio, recently made a flying trip for the establishing of agencies in New York, Boston, Providence and Philadelphia for the sale of the Brilliant incandescent lamp.

MR. MILTON B. OVERLY, general manager of the United States Telephone Company, Cleveland, Ohio, has resigned, and will have charge of construction work for the E. L. Barber syndicate, which is building a telephone system to connect Louisville, Ky., and the Gulf of Mexico. Mr. Overley's headquarters will be at Louisville.

MR. MARSHALL G. LINN has been appointed superintendent of the Bloomington & Normal (Ill.) Street Railway line and the heat, light and power plants of the system, and also of the Consumers' company, both owned by the McKinley syndicate. Mr. Linn's headquarters will be at the Consumers' company's office in Bloomington.

MR. J. R. HARRIGAN has been appointed general manager of the Zanesville (Ohio) Railway, Light and Power Company, *vice* W. A. Gibbs, resigned. For some time Mr. Harrigan had been general manager of the Columbus, Newark & Zanesville Electric Railway and the Columbus, Buckeye Lake & Newark Traction Company, with headquarters at Newark, Ohio.

MR. HORACE E. ANDREWS, formerly president of the Cleveland (Ohio) electric railway, has been placed in charge of the New York Central & Hudson River Railroad's newly acquired traction properties, with headquarters at the Grand Central station. Mr. Andrews is president of the Mohawk Valley Company, which is the holding company of the New York Central's traction lines.

NEW INCORPORATIONS.

LINCOLN, NEB.—Elm Grove Telephone Company, of Antelope county. $5,000.

COLUMBUS, OHIO—Massillon Light, Heat and Power Company. Increased from $120,000 to $300,000.

PENNSBORO, TENN.—The Hope Electric Company has been incorporated with $5,000 capital stock to construct and equip electric plants.

JEFFERSON, OHIO—Citizens' Telephone Company. $6,000. Incorporators: S. R. Fetch, E. C. Lampson, C. W. Crosley, A. M. Fairchild, O. E. Mead.

HARTFORD, CT.—The Reed & Volk Electrical Company has been incorporated with a capital of $10,000. The incorporators are Joseph A. Volk, William H. Reed and Joseph A. Volk, Jr.

CLEVELAND, OHIO—The W. J. Barr Electric Company has been incorporated with a capital of $75,000 by W. J. Barr, W. Burrell, G. M. Little, D. P. Foster and W. E. Patterson.

OLYMPIA, WASH.—The Spokane Northern Electric Railway Company. To construct, operate and maintain railroads, warehouses, wharves and terminals in Washington and Idaho. $250,000. Incorporators: Francis H. Cook, L. C. Cook and Austin A. Gubser.

HARTFORD, CT.—Articles of incorporation for the Electric Cable Company have been filed with the town clerk. The company intends to make reels, armatures, dynamos and electric motors and other kinds of electrical apparatus. It is capitalized at $500,000, but will begin business with $5,000. Incorporators: Edwin W. Moore, F. H. Cowles, of Greenwich, and I. N. Shreve, of Scarsdale, N. Y.

SEATTLE, WASH.—A ten-million-dollar corporation, which proposes to organize and maintain a general wireless telegraph business, has been formed with headquarters in Seattle by San Francisco men. The corporation is known as the United States Wireless Printing Telegraph Company. The articles of incorporation empower it to create, obtain, operate or dispose of devices now known or hereafter to be known for the transmission of verbal or pictorial messages. The incorporators are: W. D. Valentine, J. M. Duke, W. B. Kellogg, S. L. Phillips, John H. Marble, and J. D. Lederman, of San Francisco, and A. F. McLaine, of Tacoma.

ELECTRICAL SECURITIES.

The further evidence of public participation in the stock market last week gave support to the feeling that the bull campaign is not only progressing steadily, but that it is expanding to a considerable degree. Buoyancy, as well as considerable activity, has characterized much of the recent speculation. Commisson houses are not complaining so much of the absence of public buying. An encouraging feature in this buying is that much of it is of an investment character. The upward trend of prices last week was more pronounced than in some time. Sharp net advances were made for practically all of the active issues, with, in some cases, new high-price records. The December statistics were notable for establishing a new high record for monthly exports, *viz.*, $199,709,068, against $145,253,259 a year ago, and the previous best monthly showing of $174,800,000 for December, 1903. December imports of $101,155,363, while below the best monthly total, were the best for any December. December's excess of exports over imports was $98,553,705, or the largest on record for this item in any month. Foreign trade figures for the year 1905 show new high records for any calendar year, as regards both exports and imports. Total exports were $1,626,962,343, against $1,451,318,470 a year ago; while imports totaled $1,179,358,846 against $1,035,909,190 a year ago. While it can not be said that there is no room for apprehension in the stock market, the outlook has distinctly improved.

ELECTRICAL SECURITIES FOR THE WEEK ENDING JANUARY 20.

New York:	*Closing.*
Brooklyn Rapid Transit	90⅞
Consolidated Gas	172½
General Electric	178¼
Interborough Rapid Transit	235¾
Kings County Electric (ex rights)	175
Manhattan Elevated	160½
Metropolitan Street Railway	124¾
New York & New Jersey Telephone	154½
Westinghouse Manufacturing Company	190

Boston:	*Closing.*
American Telephone and Telegraph	142½
Edison Electric Illuminating	248
Massachusetts Electric	69
New England Telephone	138
Western Telephone and Telegraph preferred	97

The directors of the Western Telephone and Telegraph Company have declared the regular semi-annual dividend of 2½ per cent on the preferred stock, payable February 1.

Philadelphia:	*Closing.*
Electric Company of America	11¾
Electric Storage Battery common	85
Electric Storage Battery preferred	85
Philadelphia Electric	8
Philadelphia Rapid Transit	32⅞
United Gas Improvement	97¾

It is stated that as a result of continued industrial activity and the increased demand for electrical goods in general, the business of the Electric Storage Battery Company has shown a considerable increase.

Chicago:	*Closing.*
Chicago Telephone	138½
Chicago Edison Light	159
Metropolitan Elevated	72½
National Carbon common	81
National Carbon preferred	117
Union Traction common	12
Union Traction preferred	40

A regular dividend of 1¾ per cent has been declared on National Carbon preferred, payable February 26. Books close February 5 and reopen February 27. The annual meeting will be held February 26.

An increase in the capital of the Chicago Telephone Company was suggested in the report of President Arthur D. Wheeler at the annual meeting. The stockholders reelected the old directors. The financial report for the year ended December 31 showed that gross earnings increased $758,226, and net increased $63,194. The earnings applicable to stock were $1,626,811, or 11.62 per cent on the outstanding capital of $14,000,000. This compares with net earnings in 1904 of $1,563,616, or 11.17 per cent on the capital.

INDUSTRIAL ITEMS.

THE CONSUMERS' RUBBER COMPANY, Bristol, R. I., of which Mr. T. McCarty is president and treasurer, is now manufacturing insulated wires and cables.

THE NATIONAL CARBON COMPANY, Cleveland, Ohio, is distributing a handsome calendar for 1906. This calendar, as usual, gives the moonlight schedule for the year.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has issued bulletin No. 3108, descriptive of its single-phase induction motors, class 28 BA, of one-tenth and one-eighth horse-power.

THE STANDARD ELECTRICAL MANUFACTURING COMPANY, Niles, Ohio, manufacturer of the "Star" and "Mill" types of incandescent lamps, is soon to put on the market a new line of fan-motor apparatus.

THE WARNER ARC LAMP COMPANY, Muncie, Ind., advises that it has been awarded, during the past two weeks, eight complete contracts for municipal installations of the Warner interchangeable enclosed arc lamps.

THE STANLEY-G. I. ELECTRIC MANUFACTURING COMPANY, Pittsfield, Mass., has established an office at No. 505 Postal Telegraph Building, Kansas City, Mo., to facilitate the handling of its business in the state of Kansas.

THE CRANE COMPANY, Chicago, Ill., has issued two bulletins, No. 14 and No. 20, dealing with steam pipe specialties. Bulletin No. 14 describes Crane expansion joints, and No. 20, crane bends suitable for working pressures up to 250 pounds.

THE WEBER GAS AND GASOLINE ENGINE COMPANY, Kansas City, Mo., is now manufacturing a complete gas-producer and gas engine especially serviceable for electric light and power work where from 100 to 1,000 horse-power is desired.

THE FRANK H. STEWART ELECTRIC COMPANY, 25 North Seventh street, Philadelphia, Pa., is now placing on the market a new "Knostrain" socket bushing and handle bushing. This has the approval of the National Board of Fire Underwriters.

THE NATIONAL ELECTRIC COMPANY, Milwaukee, Wis., is mailing a card bearing an illustration of the type "N" motor, 1,000 of which were ordered by the Union Electric Light and Power Company, of St. Louis, Mo. This motor is built in all sizes.

M. C. STONE, 344 Pennsylvania avenue, N. W., Washington, D. C., is manufacturing a new seamless paper sleeve for which exceptional strength and absolute uniformity of dimensions are claimed. Samples conforming to specifications will be submitted on request.

THE WHEEL TRUING BRAKE SHOE COMPANY, Detroit, Mich., is sending out a circular calling attention to its wheel-truing brake-shoe. This shoe is to be applied to cars which have developed flat wheels, the action being to grind up the wheel and make it true.

THE ROBINS CONVEYING BELT COMPANY, New York city, has opened an office in the Frick Building, Pittsburg, Pa., in charge of Mr. G. R. Delamater, the company's resident engineer. This office is prepared to handle local enquiries relating to conveying and hoisting machinery.

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., has favored a number of its friends and patrons with a unique holiday souvenir of china made in the form of a high-voltage insulator, the individual pieces of which may be taken apart and used for three individual drinking cups.

THE PACIFIC ELECTRIC HEATING COMPANY, Los Angeles, Cal., is now manufacturing an electric iron for domestic purposes. The company offers to send one of these irons at a nominal price upon request, with a cooking stand for holding the iron inverted, making it a miniature stove which boils water in five minutes.

THE MARION INSULATED WIRE AND RUBBER COMPANY, Marion, Ind., is now manufacturing in its large new factory a complete line of rubber-covered wires and cables known as the "Eagle" brand. This product is especially designed for electric light and telephone service, telegraph, signaling, mining, marine and submarine work.

THE AMERICAN VIBRATOR COMPANY, St. Louis, Mo., is manufacturing a unique apparatus, operated by any Edison current, which is designed for massage purposes. The apparatus is of small dimensions, well constructed, the motor being entirely enclosed.

THE JOHN A. ROEBLING'S SONS COMPANY, New York city, is distributing a booklet descriptive of the work on the Panama canal. The text is by Carlos Martyn, D. D. There are a number of photographs of the men in charge of the undertaking, and illustrations of various stages of the excavation.

THE AITON MACHINE COMPANY, Harrison, N. J., in bulletin No. 61 calls attention to its standard type of steel-taping machine for wrapping steel tape on cables. The company also manufactures steel tapers in connection with other machines, and will be pleased to furnish additional information on request.

THE ONEIDA COMMUNITY COMPANY, LIMITED, Oneida, N. Y., is distributing a very unique souvenir in the form of a miniature sample of Oneida galvanized chain, which is especially manufactured for raising and lowering arc lamps suspended from mast arms. This company also offers to send eighty feet of stock chain free to central stations.

THE SWITCHBOARD EQUIPMENT COMPANY, Bethlehem, Pa., manufacturer of circuit-breakers, now operates the following branch offices: 39 Cortlandt street, New York city; Lewis Block, Pittsburg, Pa.; an office in Cleveland, Ohio, under the management of Crosby, Croft & Company; an office in Chicago under the management of Francis Raymond; an office in Portland, Ore., under the management of Pike & Beardslee.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio, manufacturer of the Buckeye incandescent lamp, is sending out a most attractive piece of literature in line with its campaign of education toward the greater use of Buckeye lamps entitled "Under the Gates of Babylon." The descriptions are in truly classical English, and the only possible indication of the real motive of the writer is the single phrase "Better Buy Buckeye."

THE ELECTRIC GAS LIGHTING COMPANY, 115 Purchase street, Boston, Mass., is distributing a large mailing-card bearing an illustration of a 300-line "Rotokoll" central energy switchboard, suitable for hotels, factories and hospitals. An illustration is also given of the "Annunciphone" switchboard. This instrument uses annunciator drop signals, and can be arranged for metallic circuit and to connect to the city telephone exchange.

THE CROUSE-HINDS COMPANY, Syracuse, N. Y., on January 1 issued a new catalogue of its recent types of condulets. These fittings are made in many different types and forms and it is the belief of the manufacturer that this line will give the electrician a complete line of fittings similar to that which the plumber or steam-fitter has had at his command. Contractors and supply dealers will be especially interested in this new catalogue.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., in bulletin No. 1501 describes and illustrates the Allis-Chalmers "Reliance" Corliss engines, belted type. This design embodies somewhat higher rotative and piston speeds than in other types and has therefore made necessary a thorough reconsideration of the details entering into the engine as a whole. A minute and close scrutiny of each and every part has been made and new designs adopted where experience has shown this to be necessary.

THE C. W. HUNT COMPANY, West New Brighton, Staten Island, N. Y., has issued catalogue No. 0511, descriptive of the Hunt "Industrial" railway. This catalogue takes up the Hunt "Industrial" railway system, and gives details of the appliances employed. Car equipments of various kinds are shown, from four-wheel flat cars with a capacity of one-half ton, to eight-wheel flat cars with a capacity of ten tons. Various types of self-dumping machines are shown, as well as cars fitted with ladles and other special appliances. The crane cars and the narrow-gauge electric locomotives used in this system are also described. The catalogue may be secured from the company upon request.